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The
Geographical Journal.

No. 3. MARCH, 1907. Vol. XXIX.

FROM THE VICTORIA NYANZA TO KILIMANJARO.*

By Captain G. E. SMITH, R.E.

In January, 1904, I was appointed to command the British section of the Anglo-German Boundary Commission east of the Victoria lake. Early in April I reached Kisumu, the western terminus of the Uganda railway, where I found my German colleague, Hauptmann Schlobach, the Imperial German commissioner, had already arrived. Lieut.-Col. Delmé-Radcliffe, after his journey west of the lake, was returning to England, but the officers of his expedition continued with me. Major R. G. Bright, C.M.G., Rifle Brigade, and Lieut. T. T. Behrens, R.E., assisted me, whilst Lieut. J. Leveson-Gower, 3rd K.A.R., was in charge of my escort. Dr. C. Chevallier was the medical officer, and Sergt.-Major A. Rehm, 4th K.A.R., C.S.M. Cox, R.E., 2nd Corpl. Macdonald, R.E., and Lance-Corpl. Strickland, R.E., completed my complement of Europeans.

The first stage of our work was to find the longitude of the point where 1° south cuts the west shore of the lake. In 1902, Lieut.-Colonel Delmé-Radcliffe's commission had obtained a telegraphic determination of the longitude of Kisumu. We connected these two points by triangulation. The co-ordinates of the western terminal being determined, the next thing was to draw a geodetic line 273 miles in length connecting the western terminal and Laitokitok, the position of which was determined by Consul-General C. S. Smith in 1892. Some additional work was required near Kilimanjaro and Taveta, and finally the longitudes were connected throughout

* Read at the Royal Geographical Society, May 7, 1906. A map will be issued in a later number of the *Journal*.

by triangulation with that of Zanzibar established in 1882 by Sir David Gill.

Detailed mapping was of course required along the boundary itself, and when favourable opportunities occurred some further topographical work was executed.

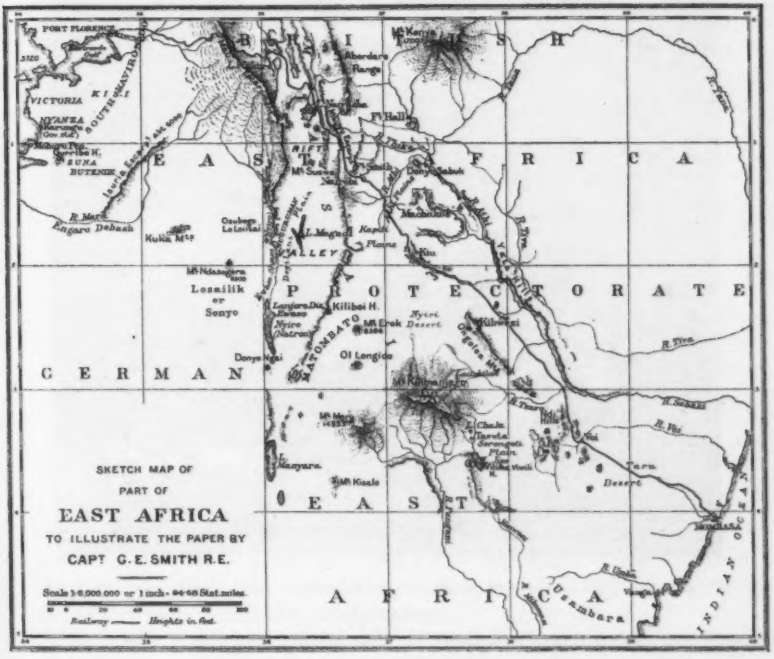
It must be recollected that the journey we were about to undertake from the Victoria Nyanza to Laitokitok was across unknown country, a distance of 273 miles as the crow flies. Joseph Thomson in 1883–4 had travelled along the old caravan route from Laitokitok to Nairobi. The route had been crossed at right angles by travellers following the Rift-valley, Count Teleki and von Höhnel in 1887–1888, Schöller in 1896–1897, and Neumann in 1894. The latter had, indeed, made his way from the Rift-valley to the Victoria lake, but he had not followed the boundary. In 1903 Major Burnham had crossed from Nairobi to the neighbourhood of Karungu, but he had only been so far south as the boundary in the vicinity of the Victoria lake. From all these sources and from others, including my own work in 1897 and Commander Whitehouse's excellent chart of the lake, we compiled a map. It had marked on it the Victoria Nyanza, and the positions of some hilltops between the Rift-valley and Kilimanjaro, but for the rest the most marked characteristic of our compilation was the exiguous amount of information to be found on it. Vague stories of water scarcity, which turned out to be not without foundation, and vaguer reports as to terrible natives reached us from British and German sources. The Kisii were known as a tribe who habitually raided the Southern Wakavirondo, whilst the position of their country was supposed to be on the boundary. In point of fact, we had no intercourse at all with the Kisii, who dwell some 30 miles at least north of the Anglo-German boundary. Mr. H. Horne, at that time assistant-collector at Karungu, was the first to locate them at all accurately, obtaining for me information, confirmed by later travels of Lieut. J. Leveson-Gower, as to their whereabouts. Some accounts exaggerated the power and numbers of the Masai whom we should meet; but I had had sufficient experience of that once powerful nation near Nairobi to be confident that we should have no great difficulty with them. The Masai have many faults which have been sufficiently recounted by others, whilst I have ever found them brave and loyal friends.

Water, I knew, was scanty during the latter half of the journey. We could only hope we should find it in the earlier part, and took with us a good supply of paraffin-tins to allow us to carry it if necessary. Water was often hard to find, especially in parts where we had not good guides. Our precautions turned out to be sufficient, and we had the good fortune to be helped by heavy rains through the most difficult country.

Our transport consisted of native porters, helped by some donkeys.

In spite of expense, porters are still the best transport through unknown regions in East Africa.

With a caravan of about five hundred men, food and transport became a matter of great importance. Very little could be obtained on the way. For twelve marches up to the Rift-valley my food base was Karungu; later, Nairobi, Kiu, and Voi, on the Uganda railway, became in turn bases. After the neighbourhood of the lake was left behind food had to be transported for our use an average


SKETCH MAP OF
PART OF
EAST AFRICA
TO ILLUSTRATE THE PAPER BY
CAPT G. E. SMITH R.E.
Scale 1:6,000,000 or 1 inch = 94·68 Stat. miles.
Railway
Heights in feet.
VICTORIA NYANZA
BRITISH EAST AFRICA PROTECTORATE
GERMAN EAST AFRICA
INDIAN OCEAN
Mt Kenya
Mt Kilimanjaro
Aberdare Range
Mt Elgon
Mt Suswa
Mt Meru
Mt Ndasegera
Lesatilik or Senyo
Kilibei H.
Mt Erok
Ol Longido
Mt Kisale
Nyiri Desert
Taru Desert
Lake Magadi
Lake Naivasha
Lake Baringo
Lake Rudolf
Lake Hannington
Lake Elmenteita
Lake Nakuru
Lake Jipe
Lake Amboseli
Lake Dembara
Mombasa
Voi
Kiu
Nairobi
Fort Hall
Fort Ternan
Fort Florence
Kisumu
Kavirondo
Uganda
Usoga
Busoga
Kavirondo Gulf
Rift Valley
Kapiti Plains
Machakos
Kikuyu
Kamasia
Elgeyo
Nandi
Lumbwa
Kisii
Kuria
Ukamba
Masai
Wakamba
Taveta
Kilimanjaro
Kibonoto
Kahe
Chala
Pare
Usambara
Mkonumbi
Vanga
Kwale
Gazi
Tanga
R. Tana
R. Athi
R. Voi
R. Umba
R. Sabaki
R. Pangani
R. Ruvu
R. Mara
R. Sondu
R. Yala
R. Nzoia
R. Kuja
R. Kerio
R. Turkwel
R. Suk
R. Guaso Nyiro
R. Uaso Nyiro
R. Ewaso Ng'iro
R. Lumi
R. Mkomazi
R. Luvu
R. Kilulumo
R. Kibwezi
R. Tsavo
R. Galana
R. Sabaki
R. Ruvu
R. Kikuyu
R. Kapiti
R. Kiu
R. Kilibei

It will be readily understood that the supply of a caravan eating about twenty-four loads a day, which had to be transported so many marches, required constant attention and anxiety, and that unforeseen delays might cause grave discomfort or even danger to the men. When shifting the line of supply, some months' notice was required to make the necessary arrangements.

A description of the country between Kisumu and Karungu has been published in papers of Mr. Hobley, of the East African Administration. The additional information obtained by me chiefly consists in the determination of the co-ordinates of various points in that part, which will be found by cartographers in an appendix. It may be

A TYPICAL SCENE, NDERE.
(*Uhlig, photo.*)

noted here that my value for the level of Lake Victoria is 3737 feet, which, depending as it does on series of reciprocally observed vertical angles, is the most reliable value yet obtained. The determination by the railway survey was 3726 feet, so that the difference is not great.

Mohuru peninsula itself, our starting-point on the lake, has several rocky hills on it, covered with large granite boulders. It had some prosperous villages growing Indian corn and millet. The inhabitants call themselves Wasuba, and are a branch of a tribe living further south. When we were at Mohuru, just before the harvest, the chief employment of the inhabitants was that of frightening the birds from their crops. They build numerous platforms, about 10 feet high, to

which they repair in the morning with a good supply of stones and a sling. Men, women, and children wear no clothes, so that the act of

THE MARA RIVER, OR NGARE DABASH, IN HALF FLOOD.

slinging sets off their figures to the best advantage. They also employ a system of cords attached to sticks about the height of the tops of their crops, which they agitate from their perches with the same object, but with remarkably small success.

In south Kavirondo quails are plentiful and much prized by the natives. They catch them alive in small traps, and keep them in cages about the size of a cricket-ball, which they hang one below the other from poles set up in their villages. It was said that the usual fee paid by the bridegroom to the bride's parents is twenty-three quails, an explanation of the trouble they take in catching them.

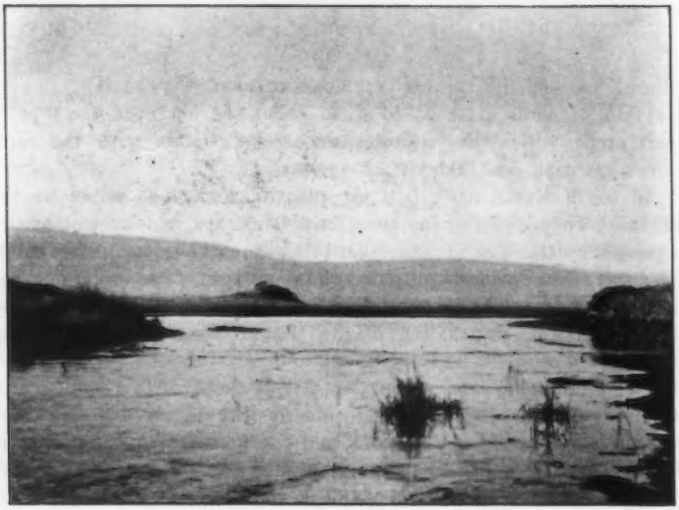
The preliminary work up to the starting-point of the boundary in Mohuru peninsula involving the measurement of two bases, careful latitude and azimuth observations, and the observation and computation of about 90 miles of triangulation was finished towards the end of July.

Proceeding along the boundary from the shores of the lake for

about 20 miles to Gurribe hill, thorn bush and veldt without inhabitants are passed. Round Gurribe hill streams of water become plentiful, and just north of the boundary the tribe of Suna, akin to the Wakavirondo, owning Gurago as their chief, is met with. They grow sweet potatoes, maize, etc., and a small quantity of tobacco and Indian hemp. They keep goats, which live in their huts at night, but have only a few cattle.

A few miles further on, some small rocky hills are inhabited by Butende. They conceal their huts among the rocks. In appearance and physique they show signs of kinship to the Masai. Their dialect appears to be very like the Suna language. The young men take much pains over their toilettes, doing their hair in elaborate styles, and wearing fine iron chains and beads round their necks. They cultivate and keep cattle.

On the German side inhabitants continue 20 miles further; but north of the boundary, after Butende only wandering bands of Masai and Wandorobo are met. It is not possible to distinguish very clearly between the two. Masai, when for any reason they become impoverished, take to Wandorobo hunting habits, and mingle on equal terms with the latter. The true Wandorobo appear to be the remains of an earlier hunting tribe widely spread. The evidence of language is as yet uncertain. Masai often speak the Wandorobo language, whilst as far as my experience goes, Wandorobo always speak Masai. But I have never heard of any European who could speak the language of



THE GWASO NYIRO, NEAR THE NATRON SEE.

the Wandorobo at all. Dr. Chavallier has told me that they resemble in appearance the Waboni of Jubaland. If language corroborates this

NGAI. STILL ACTIVE.
(*Uhlig, photo.*)

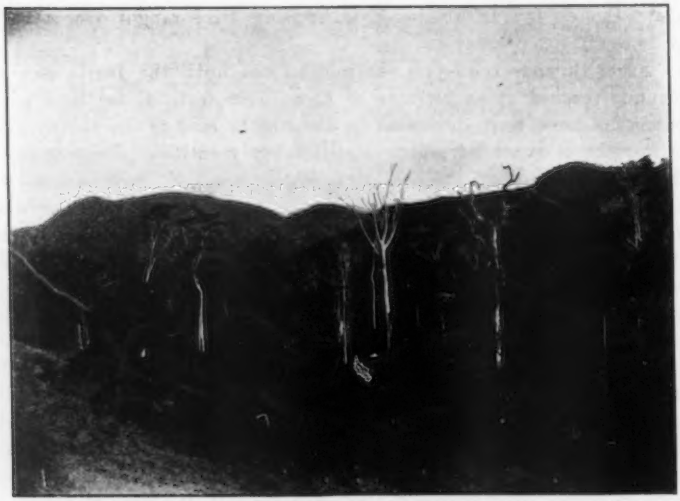
view, though few in number this hunting tribe ranges over a very wide country.

From Butende the levels continue to rise until the Isuria escarpment is reached at an altitude of about 6200 feet. Grass land with patches of forest have succeeded on the higher land to the thorny velt nearer the lake, whilst water is still fairly plentiful. Judging from the improvement in the bullocks which we took with us as an emergency reserve of food, this part is excellent for cattle, whilst game abounds. A glance at the map will show that the Isuria escarpment runs north-east and south-west, forming the western wall of the wide valley of the Engare Dabash or Mara river, which, rising far up northwards in the Mau highlands, crosses the boundary 76 miles from the lake, and, taking a wide sweep to the southwards, debouches in German territory not far south of Shirati. The view from the top of Isuria is very fine, range after range of hills rising towards the continuation southwards of the Mau. The Engare Dabash itself is a considerable stream 50 yards wide and 20 feet deep during the rains, in the dry season fordable in some places. The plains on both sides of it are not well watered, all the streams on the Isuria escarpment flowing south or west. Dry river-beds, or "olkaju," join it from the east, but as a rule the water can only be obtained in certain places by digging, until the mountains of Kuka are reached, where small streams are met which soon lose themselves in the plains.

The country continues to rise for some distance up to the watershed

dividing the water system of the Mara from the Rift-valley. To the southward the escarpment of the Rift-valley rises to its greatest height at Ndasegera, 8300 feet, and the high country of Lasiebek, whilst to the north Osubogo Lo Loiitai, of 8000 feet, forms a considerable mass, noted chiefly among the Masai for the fine manes carried by its lions. There is water on this high tableland, but, not having good guides, it was not easy to find, and Lieut. Leveson-Gower had several very hard marches in preparing the way for us in front.

The slopes of the western escarpment, where not too precipitous for trees to grow, is clothed with a fine forest, in which the juniper and other trees well known further north are met with. Most of the country we came through is uninhabited, not because the land is not good—much of it is most excellent grazing-ground—but because it has been Masai country. The Masai, under Sindeo, used to inhabit this region, spreading farther south into German territory. Lenana, Sindeo's brother, occupied the country farther north, the district near Nairobi being his headquarters. Both these brothers claimed supremacy over the whole of the Masai, and their respective partisans were continually fighting. Sindeo was under the disadvantage of not



FOREST VEGETATION AT 6500 FEET.
(Captain Behrens, photo.)

being on friendly terms with the German Government. On one side was Lenana demanding his submission, on the other he was constantly at war with the Germans. He is now completely beaten,

and lives in English territory under the eye of Lenana, and much of the country near the boundary is depopulated.

There is plenty of evidence that formerly the Masai were much more numerous and formidable than now is the case, and the Masai themselves attribute the cause of their decline, in addition to their wars just mentioned, to the cattle plague (rinderpest), which devastated their country in 1888 on its way southward towards South Africa, and to a bad attack of small-pox, which followed in the train of the famine caused by the wholesale death of their cattle.

From the top of the escarpment the drop is abrupt, with a second escarpment lying like a shelf at its foot. Good streams water its valleys, the springs of which are not usually very high up. The plain below is at the comparatively low level of about 2000 feet, and is consequently very hot. The Ewaso Nyiro and the numerous streams descending the western escarpment are kept to the western side of the floor of the Rift-valley by some minor features, and all flow into the German Natron See, where the evaporation on its hot and shallow expans s is sufficient to account for the existence of no exit from its basin. The Natron See is also fed by numerous small springs impregnated by carbonate of soda. When first I saw it the area of water was only some 10 square miles in extent, but after the January and

THE LOLGOROSSIEN MOUNTAINS AND LANGARLORIGA, LOOKING NORTH-EASTWARDS.
(*Captain Behrens, photo.*)

February rains it had spread over about 200 square miles of flats. The deposits in this lake contain much carbonate of soda, but the large quantities of sediment brought down by the various rivers when in spate probably prevent them from being particularly pure. Forty miles to the south of it rises the volcano of Doinyo Ngai, said by the Masai to be still active at times—a report which I believe has been confirmed by the observation of German travellers. The slopes of it often shine like snow in the sun with the incrustations of soda upon it.

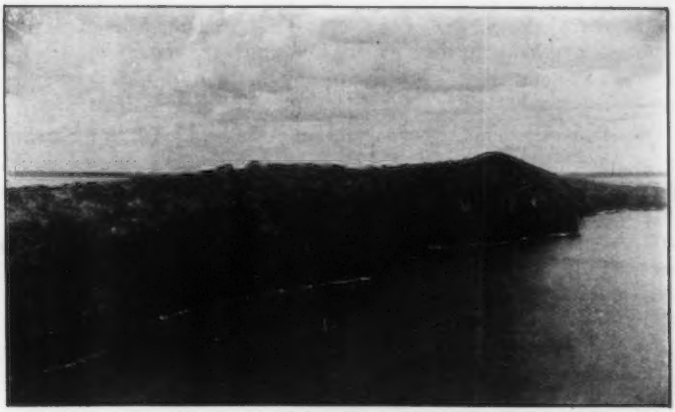
The Magadi, or soda lake, of the East African Syndicate forms a separate water system, into which only one small stream of fresh water flows. Springs of soda-saturated water ooze from below the rocks which bound it, whilst two considerable hot streams saturated with soda flow into it from the south. The lake, some 100 square miles in extent, is never more than a few inches deep, and considerable expanses of it are often uncovered. It forms a natural evaporating-pan, and the soda dug from it is remarkably pure and abundant. The dense waters of the lake and their shallowness cause the lake in that breathless region to retain or regain an unruffled surface, so that perfect reflections of the precipices to the west of it are generally seen. The soda, only differing I believe from washing-soda by the amount of water of crystallization, has an exceedingly bad effect on boots and on the porters' feet, making the former crack and the latter exceedingly tender. Thousands of flamingoes and wading birds are to be found on it, hunting for a kind of small fish which lives in the mud.

On the slopes of the escarpment west of the Magadi lake live the Nguruman Masai. The country is well chosen on a plateau between the main escarpment and the floor of the Rift-valley, and it is well watered by permanent streams from the escarpment. Unlike other Masai, these people cultivate sweet potatoes and millet, and understand a primitive form of irrigation. They keep sheep and goats, but have no cattle; are peaceable and not interfered with by other Masai during intertribal fights. They claim to supply the whole Masai tribe with calabashes. Because of their peaceful habits and from the fact that they live from cultivating the soil, they are rather despised by the rest of the Masai; but they are a definite branch of the main tribe, and send their more important disputes into Nairobi for Lenana to settle. They are not truthful like the other Masai, the effect perhaps of their low esteem among their fellows.

In German territory, some distance south of Ndasegera, is an inhabited country called Losailik, or Sonyo. The latter name is an instance of the difficulty of correctly naming places when the dialect of the guide is not well known. It means "Thingumabob," and was doubtless the answer of a guide who had forgotten the name. One mountain in those regions figured on the map in the Masai equivalent for "I forget," Atorigini. I cannot even now be certain that some of my

place-names are accurate. I had to alter one, viz. Olotoiboiologunya, which I found really meant "Your boy has gone on ahead." Since then my place-names have been edited by Mr. A. Hollis, Secretary to the East Africa Administration, and Lieut. Leveson-Gower, who are the leading authorities on the Masai language.

The floor of the Rift-valley, especially to the eastern side, is broken by numerous dykes of hard lava running parallel to one another north and south. Between them run trough-shaped valleys bounded by the dykes, which are often precipitous for miles. These characteristic dykes extend from the German Natron See to the south without interruption as far north as the Kedong river west of Kikuyu, a distance of



LAKE CHALA.
(*Captain Behrens, photo.*)

more than 100 miles, and may be traced again, though less markedly, from Naivasha to Baringo. They are usually on the eastern slopes of the Rift-valley. They are never seen on the western escarpment, which is much more abrupt in its descent. The general conditions would be met by the hypothesis of one general line of fault of great extent on the western side of the valley. If that side was uplifted, and the present floor of the valley depressed and forced under it, one would expect as a consequence the opening of extensive parallel cracks northward and southward on the eastern slopes. Extensive crack eruptions of lava might result, which still remain in the form of dykes, whilst most of the overflow above has been denuded to form the very flat floor of the Rift-valley. The suggestion is confessedly made with incomplete evidence.

Among these dykes water is scanty, especially in the region of the Magadi lake. No permanent water was found in crossing from the Ewaso Nyiro to Lanjoro Dis, about 35 miles—in the dry weather a very arduous march, necessitating the carrying of water. Lanjoro Dis is a small spring just on the German side of the boundary. It is situated on the side of the Kilibei hill forming the eastern escarpment of the Rift-valley, which is here less regularly marked than usual. There are springs of water in various places in this region, but they are not plentiful, and their permanence is doubtful in very dry seasons. The plateau of the Matumbato Masai is an extension southwards of the Athi plains near the railway; but it is more broken up by hills and mountains rising from it, of which the most considerable is Erok, or Ol Doinyo Orok, with the boundary passing over its southern slopes. Ol Longito, or Ol Legishun, faces it with an enormous overhanging mass of rock forming its northern crest, whilst beyond, Kilimanjaro the highest mountain in Africa rises to 19,328 feet.

Good grass covers the country, which is only wooded in the valleys or on the hills, Erok and Kilimanjaro having considerable forests. Water is not plentiful, springs being seldom found except near the higher hills, and even on the slopes of Kilimanjaro towards the northwest, water is scarce. The levels fall from near the Rift-valley towards the swamps north of Kilimanjaro, which vary very much in extent. The wide dry beds leading thither become torrents in the rains. They form a separate water system, not communicating above ground with the Tsavo river, which rises from springs to the north-east of Kilimanjaro. The swamps are saline, but in the rains drinkable.

Long marches from water to water were the rule, until the rains came. Fortunately they began a month earlier than usual, so that the worst country between Erok and Kilimanjaro was turned from a thirsty desert into a sea of mud, which, although unpleasant and tiring to wade through, relieved us of the difficulties of thirst.

The lower slopes of Kilimanjaro are open grass velt, with thornbush in places, and are studded with small hills, whose crater shape generally shows their volcanic origin. Rough lava rocks among the long grass often make the velt very bad to traverse. The forest on the mountain begins at a level of about 7000 feet, with an upper limit of nearly 10,000 feet. Streams are usually found in it, but often disappear beneath the lava bed, to reappear again in spring near the plain. But it is not till near Laitokitok that water is plentiful. Below the mountain to the eastwards the Seringeti plain and the plain of the Tsavo river are covered with dense thorn jungle, and the sansevera or kongi helps to make impenetrable thickets with its spiked leaves, stiff enough to pierce a pigskin gaiter. The beautiful crater lake called

Chala, first described in an official despatch as "an irregular quadrilateral triangle with its corners rounded off," and first circumnavigated by Mrs. French Sheldon, is situated to the north-east of the Taveta station.

The eastern terminal at Laitokitok, on the northern slopes of Kilimanjaro, was reached early in March, 1905, and the work of the commission up to that point was completed in July of the same year. It will be remembered that the problem before us had been to join two points 270 miles apart on the Earth's surface by a geodetic line. Although international arrangements for adjusting any discrepancy had

LAKE JIPÉ.
(*Captain Behrens, photo.*)

been made, it was a point of considerable interest what that discrepancy would be. The latitudes of the assumed positions at the two ends were, of course, not likely to be greatly in error, but the longitudes were not previously connected with one another. The western terminal longitude was deduced by our triangulation from that of Kisumu, which had itself been fixed by telegraphic exchange of time-signals from Mombasa. The longitude of Mombasa was taken from the Admiralty chart, and depended on chronometer run from Zanzibar. The longitude of Laitokitok was fixed by Consul-General C. S. Smith in his boundary survey of 1892, his longitudes depending on the value assigned to a hill called Jumbo on the Admiralty chart, whose position had been fixed by cross

azimuths from two positions whose longitudes depended on chronometer runs.

The distance at right angles to our geodetic line by which we missed the east terminal was about 95 yards, whilst the discrepancy in longitude was 6″·6 of arc, or about half a second of time. The smallness of this discrepancy confirmed in a remarkable manner the general accuracy of the previous work of various different authorities. Hauptmann Schlobach's triangulation, which was independently observed and computed, never differed from mine by more than about 100 feet.

After July, 1905, some additional work was done in the region of Taveta, again confirming the accuracy of Consul-General C. S. Smith's trigonometrical points. My triangulation, in conjunction with that of Hauptmann Schlobach, was carried on to the Usambara hills, where it was joined up with the German Government Survey, which is of a high order of accuracy.

From the southern end of this survey a few additional triangles were observed connecting it with Zanzibar, whose longitude was established by Sir David Gill during the longitude operations connecting Capetown and Aden. The whole work was complete at the end of December, 1905.

The geographical results of my expedition include a series of triangles without break from Zanzibar to Kisumu, and are themselves connected with Lieut.-Colonel Delmé-Radcliffe's chain from there to the intersection of the Anglo-German and Anglo-Congo boundaries west of the Victoria lake.

Sir David Gill assigns a probable error of $\pm 0{\cdot}5$ second of time to his Zanzibar determination of longitude. I consider that the longitude error over the whole of the long chain described should be less than ± 1 second of time.

I cannot close my account without acknowledging the assistance that I have received in preparing this paper, especially with regard to photographs for lantern slides, from the officers who were under my command. In Africa my German colleagues gave me every assistance and constant hospitality. The officials of the East African Protectorate and of Zanzibar were most kind in their help and in exercising the boundless hospitality of the remoter parts of the British empire.

APPENDIX.

The instruments used for trigonometrical and astronomical work were two 6-inch and one 5-inch Troughton & Simms transit micrometer theodolites. Plane-tables were used for mapping; 400-feet steel tapes were used for base

measurements. Temporary tripod beacons were erected at the main trigonometrical points. In all main triangles all angles were observed.

The constants of the Survey of India and the formulæ of pages 69–72 appendix, Auxiliary Tables, Survey of India were employed.

Azimuths were observed at seven stations, with an average probable error of $\pm 1''{\cdot}3$, with values varying from $\pm 2''{\cdot}6$ to $\pm 0''{\cdot}2$. Latitudes were observed at seven stations, with an average probable error of $\pm 0''{\cdot}4$, with values varying between $\pm 0''{\cdot}6$ and $\pm 0''{\cdot}1$. Four bases were measured, with probable errors of 1 : 200,000; 1 : 100,000; 1 : 154,000, and 1 : 645,000; mean triangular error = $6''$.

A consideration of the errors tabulated will show that the work done is good secondary triangulation. Especially should be noticed the good agreement between astronomical and triangulated latitudes at Vilima Viwili. At both Mohuru and the latter place there is no *à priori* reason for expecting local attraction. At Vilimi Viwili the earlier work of 1892 led me to expect this result. It does not appear that any general readjustment of the triangulation is called for; indeed, nothing short of a discussion by the Method of Least Squares would give more reliable results. It is generally agreed amongst geometers that only the most accurate geodetic work possible with the largest instruments is worth the expensive and laborious process of such adjustment.

TABLE I., SHOWING ON WHAT BASE, AZIMUTH, AND LATITUDE VALUES THE DIFFERENT SECTIONS OF THE TRIANGULATION WERE COMPUTED.

Names of ends of sections.	Base.	Azimuth.	Latitude.
Kisumu Mohuru	Mean of Kisumu and Schirati each meaned with Germans.	Mohuru meaned with Germans.	Mohuru meaned with Germans.
... ...	Ditto.	Ditto.	Ditto.
Kebololet Shombole	Ditto.	Kebololet.	Ditto.
... ...	Guaso Nyiro Mosquito Camp.	Mosquito Camp.	Ditto.
Kilibei Laitokitok	Ditto.	Above azimuth meaned with Germans.	Ditto.
...	Above length meaned with Germans.	Observations at Laitokitok meaned with Germans.	Above meaned with Germans.
Vilima Viwili ...	Ditto.	Ditto.	Ditto.
Schageïn Tongwe	German Government Survey.	German Government Survey.	Ditto.
Zanzibar	Ditto.	Observed Genda Genda meaned with German Government Survey and observed at Zanzibar.	Ditto.

TABLE II.—BASES, DIFFERENCES BETWEEN TRIANGULATED AND MEASURED LENGTHS.

Place.	Measured on triangulated length.	Difference.	
		+	−
Kisumu	from Schirati		1 : 300,000
Mosquito camp	from Schirati	1 : 1,500,000	
Taveta	from Mosquito camp		1 :23,800
German Government Survey side Schageïn *	from Mosquito camp		1 : 5,700

At Lolgaria a logarithmic correction of +0·0000402 foot was applied to mean results with German Commission. In making the above table of differences, this correction has been taken off our values again.

TABLE III.—LATITUDE, DIFFERENCES BETWEEN OBSERVED AND TRIANGULATED VALUES BASED ON MOHURU.

At place.	Difference.	
	+	−
Kisumu, Bungalow beacon	9″·28	
Mohuru	0″·0	
Kebololet	1″·27	
Guaso Nyiro, Mosquito camp	3″·61	
Laitokitok camp		9″·87†
Vilima Viwili	0″·65	
Zanzibar		3″·29

Corrections were applied to the English triangulation—

(1) At Kilibei ... ... −0″·469
(2) „ Lolgaria ... ... −0″·104

in order to mean with results of German Commission. In making out the above table of differences, these corrections have been added on again to the triangulated values that appear in the computations.

TABLE IV.—AZIMUTH, DIFFERENCES BETWEEN TRIANGULATED AND OBSERVED VALUES FROM WEST TERMINAL TOWARDS EAST.

			Difference.	
			+	−
Azimuth from	Mohuru,	compared at Kebololet, observed		2″·9
„	Kebololet	„ Shombole (Mosquito camp), observed	3″·8	
„	Shombole	„ Laitokitok camp, observed	9″·1	
„	Laitokitok	„ Vilima Viwili, observed	5″·3	
„	Laitokitok	„ German Government Survey, observed	0″·3	
„	German Government Survey, Tongwe, observed	compared at Tongwe,		3″·3

* This last comparison was made through a bad triangle indifferently observed.

† A large error of about this amount was to be expected owing to the mass of Kilimanjaro, and may be attributed to its local attraction.

At (1) Kilibei a correction − 3″·0 in azimuth
(2) Lolgaria „ − 7″·9 „
were applied to mean results with German results. In making out the above table of differences, these corrections have been readded.

TABLE V.—REFRACTION TABLE.

No. of determinations.	In area near	Approximate height above M.S.L.	Coefficient of refraction.
7	East shore, Victoria Nyanza	For rays crossing lake	0·087
		For rays crossing land	0·073
11	Kwere	5500	0·075
6	Kijarimweta	6000	0·070
8	Kuka	7000	0·066
12	Erok	7000	0·062

TABLE VI.—PRINCIPAL STATIONS.

Trigonometrical Points.

The following is a recapitulation of the positions of all triangulated points, copied from the triangulation charts of the Expedition :—

	Latitude.		Longitude.		Height.
Kibo ...	3° 4′ 34″·1,	...	37° 21′ 1″·3, ± 21 feet	...	19,328, ± 6 feet.
Kimawenzi	3° 5′ 38″·05, ± 0″·014	...	37° 27′ 17″·03, ± 0″·007	...	16,899, ± 1·5 „

Name.	Latitude S.	Longitude E.	Height in feet.
	° ′ ″	° ′ ″	
Maraguil	0 0 17·07	34 39 31·39	—
Kisumu, observation spot, railway station	0 6 0·62	34 4 41·7	
Kibuye	0 8 30·93	34 43 52·96	—
Ndere island	0 12 23·75	34 30 21·13	—
Homa	0 23 14·30	34 29 42·90	5757
Wire	0 28 8·97	34 42 32·18	—
Ruri	0 33 22·88	34 21 37·77	5600
Gem	0 38 2·29	34 31 41·02	4694
Gwasi	0 37 32·55	34 11 18·05	6399
Mbala	0 47 57·01	34 26 10·33	4581
Uganju	0 46 27·07	34 5 0·75	4346
Nundowat	0 51 30·32	34 12 34·18	4494
Pyramid island	0 54 7·56	33 55 57·36	4256
Mohuru Cement Pillar	1 0 24·24	34 3 45·17	3986
Nyamanyuni	1 10 46·27	34 7 13·05	4930
Guigeggo	1 14 52·22	34 17 0·92	5162
Kwere	1 3 8·75	34 18 58·78	4873
Muema	1 14 51·29	34 23 28·25	5358
Shirari	1 15 24·42	34 28 13·60	5548
Nyamahengu	1 18 46·46	34 33 53·91	5931
Tagari	1 23 32·31	34 37 12·97	6050
Sigaa	1 8 24·47	34 44 6·04	6116
Kijarimweta	1 21 20·69	34 51 31·54	6451
Nesheshaw	1 38 43·01	34 55 0·69	5377
Moggone	1 25 12·40	35 0 22·21	5327
Kebololet	1 34 46·43	35 8 59·90	5482
Kebololet, observation spot	1 35 55·5	35 8 26·9	5063

Name.	Latitude S.	Longitude E.	Height in feet.
	° ′ ″	° ′ ″	
Kuka	1 42 59·87	35 15 1·85	7161
Leganisho	1 35 49·78	35 24 3·98	7247
Mundorosi	1 53 2·74	35 26 49·84	7621
Ol Albwa	1 40 19·29	35 30 39·28	7513
A	1 47 22·36	35 41 48·92	7707
Ndasegera	1 57 58·97	35 42 41·60	8303
Escarpment	1 50 56·66	35 57 5·69	7677
Sambu	2 8 30·33	35 56 51·28	6383
Shombole	2 7 33·16	36 5 45·74	4850
Base, North, Guaso Nyiro, observation spot	2 0 59·89	36 8 25·46	2048
12	2 2 21·39	36 20 56·18	3181
Killibei	2 22 21·76	36 26 25·34	6973
Luanji	2 13 19·29	36 33 45·88	6612
Erok	2 29 38·32	36 44 54·92	8386
Elemobarasha	2 13 1·96	36 52 45·74	6890
Enoiiti	2 46 36·72	37 7 2·47	4207
Meshanai	2 32 17·16	37 10 53·90	4010
Endoinet	2 55 19·16	37 25 33·04	7167
Naduyatui	2 42 30·18	37 29 20·54	4134
Camp, observation spot Laitokitok ...	2 56 13·41	37 31 16·08	5562
East Terminal (T. 1)	2 57 19·32	37 31 16·01	5881
Longailil	2 55 46·99	37 33 8·34	5206
Longaria	2 56 2·48	37 35 31·06	5222
Losoiito	2 42 11·59	37 37 7·58	4324
Nagavai	3 0 47·00	37 44 6·34	4001
Soiiti Sambu	2 44 57·56	37 49 29·56	4242
Y	2 59 11·19	37 59 1·58	2691
Losoiito (Mog. 9)	3 14 46·83	37 52 54·03	4021
Chala (Nakurtu)	3 19 25·10	37 41 3·15	3692
Ndui ya Warombo	3 21 48·18	37 43 48·12	3083
El Oldorobo	3 23 20·97	37 47 9·42	3098
Latema	3 24 12·35	37 37 3·52	3660
Mokinni	3 29 50·87	37 38 8·85	3458
Vilima Viwili	3 34 44·57	37 47 53·37	3105
Erakatawya	1 25 37·11	34 45 43·84	6185
Aiburr	1 30 21·0	34 56 53·0	5177
Loldobaih	1 30 56·0	35 3 1·0	5252
Losegin	1 38 51·30	35 19 46·08	6843
88	2 26 49·05	36 33 31·47	6976
Melwaioni	2 22 19·91	36 55 32·04	5295
Lemomo	2 46 24·89	37 15 5·69	4517
Engero	2 48 36·46	37 24 45·95	5124
Songai (not plotted)	1 0 1·58	34 2 32·28	—
Intersected points.			
Jipe S.	3 40 32·0	37 37 57·0	2342
Usange	3 41 19·46	37 38 1·91	6324
Ndea...	3 51 51·09	37 53 41·39	4638
Kwizu	4 6 32·05	37 52 24·47	6257
Tussa	4 9 24·26	38 5 7·29	4201
Vunta	4 28 51·16	37 57 37·35	6631
Schageïn	4 30 57·14	38 17 33·08	7320
Segera	5 18 38·11	38 33 12·08	—
Tongwe	5 18 21·45	38 43 36·25	—
Kofi	5 28 50·0	38 21 46·0	—
Genda Genda	5 34 16·57	38 38 40·22	—
Kondussi	5 48 8·67	38 35 11·06	—

Name.	Latitude S.	Longitude E.	Height in feet.
	° ′ ″	° ′ ″	
Zanzibar (Z.1)	6 9 45·80	39 11 4·72	—
Ugisero	1 1 54	34 6 3	3928
Mo. 7	1 1 23	34 3 7	3883
Nun. 18	1 11 11	34 10 24	4913
Mo. 1	0 59 4	34 4 51	4065
Taveta Flagpost	3 23 51	37 40 32	2511
78	2 29 11	36 44 54	8097
1	3 51 50	37 53 41	4623
2	3 50 33	37 50 33	4093
3	3 51 48	37 48 34	5159
4	3 51 10	37 47 55	4857
Kiambo I.	0 40 21	34 17 43	5390
Nun. 19	1 11 50	34 7 34	—
Taragut	1 15 40	34 27 54	5628
Mog. 12	3 9 30	38 1 40	4554
Lessengin (Mog. 15)	3 0 23	38 9 5	5990
86	2 58 37	37 59 39	3191
Sengin	2 54 56	37 52 38	3723
b.	2 48 28	37 53 15	3939
Mog. 10	2 47 29	37 58 27	5992
Kiambo II.	0 43 30	34 13 5	5784
Kiambo III.	0 46 49	34 8 11	5198
Tigra	0 47 24	34 8 23	5046
Mo. 6	1 1 55	34 3 12	3794
Nhiakuru	0 53 35	34 20 24	4635
Kingamata	0 57 47	34 21 59	4851
Masara	0 58 25	34 17 4	4308
Tingana	0 59 4	34 26 52	5382
Mo. 8	0 58 43	34 3 51	3737
Mo. 2 (Guekeri)	0 59 33	34 5 42	3998
II.	1 2 47	34 9 7	4139
III.	1 3 45	34 9 56	4258
Nun. 20	1 11 15	34 7 10	5028
Bitambi (Nun 17)	1 11 33	34 10 49	4940
2 Rocks	1 11 5	34 13 10	4812
Gurribe Tree	1 7 37	34 16 29	5070
K.T. 3	1 8 30	34 19 26	4866
Niasoku	1 4 46	34 20 31	4885
Mkurue	1 2 7	34 22 32	4786
Buku (K.T. 4)	1 12 4	34 23 24	5123
K.T. 1	1 3 33	34 24 51	4900
Butende	1 11 6	34 26 12	5271
Tarageti	1 13 20	34 30 58	5376
Two Rocks	1 17 20	34 36 29	5860
Chilato	1 14 2	34 38 40	5703
K.J. 4	1 6 23	34 39 47	5669
Mwita A.	1 4 16	34 42 34	6582
Mwita B.	1 5 58	34 45 30	6705
Lolgorien	1 13 13	34 46 10	5791
Longawonne	1 10 42	34 46 29	6084
Erok	1 19 48	34 47 17	6166
1	0 58 38	34 52 41	6892
Lolmaiinget	1 1 42	34 53 47	6754
23	0 56 43	34 54 9	6785
2	1 30 50	34 57 54	5272
4	1 31 23	34 59 7	5249
3	1 24 10	35 1 30	5321
1a	1 13 55	35 1 1	6216

Name.	Latitude S.	Longitude E.	Height in feet.
	° ′ ″	° ′ ″	
26	0 54 27	35 4 47	6847
27	0 49 8	35 5 47	6531
9	1 39 10	35 7 45	6137
15	1 24 7	35 13 16	5514
16	1 16 17	35 23 14	6981
13	1 6 14	35 15 13	7092
25	1 5 10	35 18 41	7083
Longwatat	1 36 12	35 20 10	6783
Lenderut	1 43 2	35 20 49	7174
8	1 34 35	35 23 15	7225
5	1 22 57	35 25 50	6160
Mwusilo	1 41 16	35 26 52	7374
49	1 44 59	35 27 45	7075
43	1 39 59	35 28 32	7282
50	0 54 45	35 28 26	7495
53	1 52 2	35 29 40	7310
18	1 36 24	35 33 49	7357
40 (Rocks)	1 47 10	35 32 56	7205
40 (Top)	1 47 1	35 35 5	7332
55	1 16 27	35 25 55	6574
52	1 53 52	35 33 15	7688
51	1 46 23	35 36 42	7377
39	1 57 11	35 37 34	8348
54	1 44 43	35 40 38	7210
62	1 36 19	35 41 36	8087
63	1 49 22	35 42 21	7553
32	1 32 24	35 43 4	8233
59	1 46 38	35 44 58	7296
56	1 44 39	35 47 39	7751
33	1 39 10	35 49 8	8782
34	1 39 29	35 49 24	8818
60	1 48 32	35 50 15	7554
65	1 53 11	35 51 9	7447
58	1 55 13	35 51 17	7523
66	1 54 18	35 52 22	7554
71	1 40 23	35 52 7	8822
57	1 44 17	35 53 28	8777
72	1 42 40	35 54 21	8154
67	1 58 45	35 55 21	6933
64	1 47 22	35 56 52	7730
80	1 57 46	36 1 10	4553
Shombole Top	2 8 8	36 5 18	5173
Gellaich	2 36 46	36 6 8	9664
Point on Magadi	1 56 3	36 15 15	2057
Lenderut	2 5 42	36 16 58	4072
Suswa (Ol Doinyo Nyuki)	1 10 29	36 20 48	7673
Lorgosailich	1 41 34	36 25 0	5667
Lu. 7	2 19 11	36 26 14	6012
Longonot	0 54 55	36 26 42	9012
85	2 13 23	36 29 18	5062
Meto Tree	2 23 41	36 30 41	6874
70	2 19 22	36 31 53	6925
Lasagut	1 30 9	36 32 35	6855
75	2 8 29	36 34 5	5732
Lamwia (Lamuyu, Ol Doinyo Ol Aisur)	1 25 13	36 38 12	8031
Telethungetung	1 51 35	36 39 38	5888
73	1 44 26	36 40 6	6622
69	2 19 48	36 39 27	6849

Name.	Latitude S.	Longitude E.	Height in feet.
	° ′ ″	° ′ ″	
Longido	2 41 52	36 42 45	8645
74	1 59 32	36 44 3	6974
Lemeboiti (Bisil)	2 8 28	36 45 12	7018
Erok N. Rock	2 26 53	36 45 34	7648
Arusha (Meru)	3 14 32	36 44 49	14,962
East foothill	2 30 47	36 49 45	6180
Lolginegi	2 44 13	36 56 3	3972
Rocks	2 41 14	37 0 0	3898
N. 3	2 41 14	37 9 10	3978
Merrisherri	2 40 52	37 10 45	3984
No. 2	2 43 3	37 11 51	3989
El. 1	2 30 50	37 29 48	4205
El. 2	2 31 47	37 29 13	4439
Olobrauk	2 53 11	37 25 56	4959
Malagogoi (W.)	3 21 33	37 39 45	3577
T.	3 22 59	37 33 54	2935
Reata	3 25 47	37 38 40	3175
U.	3 26 29	37 35 1	2603
Ugweno	3 34 10	37 39 59	6135
Ugweno foothill	3 34 22	37 43 21	2834
Ugweno 2	3 33 29	37 35 44	5779
Mbare	3 44 21	37 38 57	6981
Lonukeri	2 36 41	37 41 24	4202
Sambu	2 36 39	37 43 39	4768

Before the paper, the PRESIDENT: Captain Smith, who in Africa has the local rank of Colonel, is known to our Society mainly by his having read a paper to us of a very excellent character some seven years ago on road-making and surveying in East Africa. Captain Smith is an Engineer officer who went out to East Africa in 1892, and has made repeated visits there, during which he has done a great deal of useful work; but a little over two years ago he was appointed by His Majesty's Government as the head of the British section of the Anglo-German Commission for marking the boundary between the Victoria Nyanza and Kilimanjaro. His expedition lasted for a period of about a year and eight months, and terminated a few months back. Captain Smith has, during the course of that period, not only done good political work, but also some excellent geographical work. I am told that his survey work on that expedition is of a remarkable character. I should mention that we have here to-night one or two distinguished guests from East Africa. We have His Highness the Sultan of Zanzibar, whose ancestors have had a long and historic connection, as you know, with all those regions. And, in the next place, we have present here to-night Hauptmann Schlobach, the leader of the German section of this boundary commission, who has done us the honour of coming from Berlin to-day for the express purpose of being present at this meeting. During that expedition of a year and eight months the most perfect harmony existed between the German and British sections of the expedition. That does great credit to Hauptmann Schlobach and his companions, and also to Captain Smith and his companions; and it is one more proof that Englishmen and Germans, when not incited by over-zealous newspapers, can work together just as harmoniously as they did in the days of Frederick the Great. I will now call upon Captain Smith to read his paper.

After the paper, the PRESIDENT: I am sure you will now wish me to invite Hauptmann Schlobach to address a few words to this meeting.

HAUPTMANN SCHLOBACH: This my first visit to England is undertaken to accept the very kind invitation of the President and Council of the Royal Geographical Society. I need not assure you that I feel greatly honoured by this kindness, and by the fact of my being here you can see that I was always able to work harmoniously with my British colleagues in Africa, not only with regard to the boundary work, but all through our private relations were very friendly. The work we have done has doubtless some scientific value, and I would direct your thoughts to the fact that our work had not only a local interest, but possessed a wider character, as we succeeded in joining the 30th meridian with Zanzibar, which has been accurately fixed with Cape Town by the exchange of electric signals. I hope very soon to see my British colleagues in Berlin. And now I have to thank you once more for the kind hospitality you have shown me this evening, and I would say how much pleasure and honour it has given me to be amongst the members of this the most distinguished Geographical Society of the world.

The PRESIDENT: I now propose calling upon Sir Clement Hill, a Member of Parliament, as well as of our Council, not because he is a member, but because he has not only visited these regions, but, for many years at the Foreign Office, was a sort of autocrat who directed their destinies. I hope he will kindly say a few words.

Sir CLEMENT HILL: It gives me peculiar pleasure to stand here to-night, partly owing to my near acquaintance—official, and, I hope I may say, friendly—with the Sultanate of Zanzibar, whose Sultan we are proud to welcome amongst us to-night, and partly because I had the privilege of accompanying Sir Bartle Frere, one of your Presidents, to Zanzibar in 1873, where we received, even in times of great stress, when relations were not so easy in those countries as they now are, a most cordial and friendly welcome from the Sultan. I am proud to think that these relations have been encouraged and improved since, till we welcome amongst us the Sultan of the present day. He was educated at Harrow, talks English, understands the character of the English nation, and, I am quite certain, will do his best to give that support to the geographers, explorers, and commercial men of this empire which his ancestors have always accorded to us before. I remember when we went to Zanzibar, the great traveller Livingstone had recently been rediscovered by Stanley. We went out with an expedition fostered and promoted by this Society to give relief to Livingstone. That was the expedition of Cameron. It shows the great difference of the conditions of those times when Cameron's expedition, which started from Bagamoyo, had the greatest difficulty, not only in making a start, but in making any progress at all. Out of the four Europeans who started, Cameron himself was the only one who survived to cross the country, and he came out in Portuguese territory two years afterwards. That was one of the great journeys made by a representative of this Society. Now we have the great difference that our representatives will come back after journeys which, in their way, are at least as important and almost as difficult as Cameron's, and they receive hardly any notice in the Press. They report to us how they communicate with one another, they fix their different positions by telegraph, they get to their destination by train, they have their caravans with the very easiest methods of transport, and, instead of all the difficulties and all the deaths which occurred before, they come back amongst us well and strong to say that the country is a habitable country and that it has a still greater future than that which has already been brought to it by the efforts of geographers. The work of the Foreign Office has always been to encourage cordial relations with our friends of other countries

who march with us, and all the time I was in the Foreign Office, I believe I can honestly say that there never were any difficulties with our German friends on the frontiers. They have since shown how cordially they can work with us by the work which we have seen shown on the screen and by the description which has been given us, and I am quite certain that those relations in Africa will always continue. Captain Smith has not told you what he must be very proud of, namely, that the Smith whom he alluded to as having made these excellent surveys was his brother. He was the person who brought the survey from the coast to Kilimanjaro, and it has been given to the two brothers of that family to complete the whole of that boundary between Germany and the British sphere. I can only add, I am profoundly impressed by the advance which has been made in our knowledge of East Africa, by the facilities which are given, and by the extraordinary friendliness of the natives whom we meet there, and the great ease with which travelling is now done throughout the eastern coast of Africa. I think, before I sit down, that I should like—I am not quite certain whether it is in my province properly to do so—but I can hardly refuse myself the pleasure of calling your attention to the fact that we have amongst us the representative of a newly born kingdom. We have here amongst us a man whom many of you have listened to, when you heard in the Albert Hall, as I did, that extraordinary history of his wonderful journey towards the north pole—I mean Dr. Nansen. I am sure we shall all cordially welcome him, and, although he cannot tell us about tropical Africa, we can feel in his presence, that whilst we are warmly inclined to him, he will not have a cooling influence amongst us.

The PRESIDENT: I will now call upon Major Bright, whom you may remember is the recipient of one of our awards this year. He accompanied Captain Smith in his expedition, and he has done excellent work in other parts of Africa.

Major BRIGHT: The comprehensive paper which Captain Smith has read this evening does not leave much need for additional information. A fact, perhaps, worthy of notice is, that during the commission's journey no trouble was experienced with natives through whose country it passed. For about three and a half years British and German officers were working together delimitating the boundaries between their respective protectorates. That they were not only on speaking terms, but on the best possible terms, with each other, after spending such a long time together in such tropical and trying climates, speaks well of the tact and good feeling displayed on both sides. Hauptmann Schlobach, in conjunction with whom the British were working, is present this evening, and I can only express the sincere pleasure his arrival in England has given to those who were so long his colleagues in East Africa and Uganda. Captain Smith, not content in having already surveyed a considerable portion of East Africa—he has been out there on three separate expeditions surveying—is shortly to return as Surveyor-General, and I can only tell him that he carries with him the best wishes of all the officers, myself included, who had the pleasure of serving on his last expedition.

The PRESIDENT: I will now call upon Major Close, who, as you know, in the Intelligence Department of the War Office, takes charge of what I may call the military geographical information of all the British Empire, with the exception of India. He is the highest living authority on the geography of the British Empire from that particular standpoint.

Major CLOSE: Our explorers and surveyors, like Captain Smith, do their best to make Africa uninteresting. We have every year a great succession of elaborate surveys—and how elaborate, I suppose, only those know who are, so to speak, in the technical world—which are gradually reducing Africa to a place as well known as the United Kingdom. There is hardly a town in Africa that we do not know

the position of, within about 10 miles—in fact, most towns we know within 2 or 3 miles.

Major VILLIERS: I am sure it is quite an unexpected honour to me that I should be asked to address this meeting. It is a great many years since I was in East Africa, but the photographs which we have seen depicted on this sheet have brought home very vividly to me the long marches I had many years ago with the late Sir Gerald Portal. It was owing entirely to the late Sir Gerald Portal that this country was taken over, and I feel certain that in the near future we shall find that East Africa will form one of the brightest gems in the British Empire. It is capable of growing almost anything, it has every class of soil and every class of climate. In finding one's self on an expedition such as I was on many years ago, one looked forward to what the future might bring forth for this country, and I must say that I think the Foreign Office can congratulate itself upon the enormous developments which have taken place. When I walked to Uganda it took us seventy-five days to walk there from Mombasa, but now we find a railway which will take you there, I believe, in about two days, and halfway up the railway, I hear, there is a large town sprung up at Nairobi, which in those days was open veldt inhabited by game. I think no one could walk through a country like that without having great interest in the country, and I have, I am glad to say, been able to try, in a small way, to help the development of that country. For the last two or three years we have been trying to start Australian sheep there, and there is no doubt that on the high plateau in East Africa the Australian sheep will live and thrive very well. Also in that country, at an elevation of, say, 6000 feet, the white man will be able to live and farm and earn a good living. I think one of the drawbacks to East Africa is, that up to the present time it has not been properly developed, and people do not know enough about it. There is, between Uganda and the coast, a country of many thousands of square miles, where white men can undoubtedly live and live well. Again, in East Africa no doubt a large part of the country is fit for the overflow population of India. Up to the present time, I believe that no minerals have been found in the country; but if minerals are found there, the Government will find that they have the same difficulty to contend with in East Africa as they had in South Africa, namely, the labour question. I think, before I sit down, I cannot do better than draw attention to the fact that this fine country is the natural place for the overflow population of India, and more attention ought to be drawn to that fact than has been hitherto.

The PRESIDENT: I now rise to propose a hearty vote of thanks to Captain and Colonel Smith for his very interesting address. Some remark was made about geographical details; you will find full details of the geography of his expedition in the *Journal* of the Society. We have had an interesting discussion, and I only propose to say a few words on one remark which the last speaker made. He said it was Sir Gerald Portal who took over those countries; it is perfectly true Sir Gerald Portal took them over for the Crown, but I hope it will never be forgotten that those countries were acquired by the Imperial British East Africa Company, and if it had not been for the efforts of Sir William Mackinnon and his associates—I am sorry not to see Sir George Mackenzie here to-night—there would have been no British East Africa to take over.

NINE YEARS' SURVEY AND EXPLORATION IN NORTHERN AND CENTRAL CHINA.*

By Lieut.-Colonel A. W. S. WINGATE.

The many accounts which I have read of the Great Wall (especially one in a book published by John Murray this year) are inclined, in my opinion, to convey a totally false conception of this Brobdingnagian undertaking. I have seen it in over twenty different places widely apart, and have heard many verbal descriptions of it in other places from travellers, and I have arrived at the conclusion that it was built by degrees and in sections in the first instance, not of hewn stone, but of round boulders and earth, and that the different sections were repaired from time to time as they fell into ruin. Only in the valley bottoms and on the passes was it composed of masonry or brickwork. The Mings rebuilt of solid masonry all those sections through which led a likely road for invading Tartars to follow, or where it could be seen from a distance against the sky-line; of these the chief, and the only one really worth a journey to see, is at Ch'a-tao, the northern entrance to the Nan-k'ou pass. The First Emperor's conception may have been a great one; but with a population like the Chinese, and a system of government like that in existence in China before Christ, the building was a sufficiently simple affair, and not to be compared, as it has been, with the Great Pyramid of Egypt.

But to continue. Our road crossed several passes, notably Tsŭ-ching-kuan (1800 feet), 15 miles west of the Hsi Ling, the scene of conflict in 1900 between Chinese troops and Boxers on the one side, and German, Italian, and Indian troops on the other. That this should have been so was quite in accordance with the dictum that history repeats itself; for it was by the road leading over this pass (and the one we followed) that successive hordes of Mongols and other invading armies have descended on to the fertile plains of Chih-li. Though once a cart road throughout, it is now only passable for animal-pack transport where it leads over the pass. The construction of the railway, now well advanced, from the Pei-han line at Cheng-ting Fu to T'ai-yuan Fu, the capital of Shan-hsi, will hasten the abandonment of this difficult road as a trade route.

It is impossible, in the limited space at my disposal, to describe in detail all we saw of geographical interest on our way to Wu-t'ai Shan. A few general remarks must therefore suffice.

The main geological characteristic is limestone covered by loess forming a succession of fantastically shaped mountains almost bare of

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* Read at the Royal Geographical Society, December 17, 1907. Maps, p. 368. Continued from p. 200.

trees or vegetation of any kind, interspersed with narrow, but extremely fertile valleys, watered by streams of varying dimensions, but similar in general characteristics. The roads or paths mainly follow these river-beds, which are more often than not a mass of stones; so progress is slow and very laborious. In the loess the going is excellent when dry, and, owing to its adhesive and slippery character, it is easier riding or driving than on foot.

On August 28 we crossed the divide between Chih-li and Shan-hsi provinces at P'ing-hsing-kuan, 4500 feet. Heights are only approximate. Careful observations with B.P. thermometers and aneroids were taken throughout the journey; but the results, as worked out by Captain Turner, are not available for inclusion in this paper, but will, I hope, appear in the published maps.

From this elevation we obtained our first view of the northern peak of the Wu-t'ai Shan, 35 miles distant. On this pass only a few towers remain to mark the alignment of what was once an inner branch of the Great Wall. The people along the route speak with a different accent to that of the inhabitants of the Great Plain; they are more timid, less intelligent, ruder, and have not the habit, as is the custom further east, of passing one the "time o' day." There are numerous orchards, chiefly apple, apricot, the jujube plum, and walnut.

On August 29 we experienced a very heavy hailstorm; the size of the stones varied from that of a pea to a pigeon's egg. It only lasted fifteen minutes, but caused such a heavy spate in the river-bed as nearly to drown a surveyor. Such hailstorms are of frequent occurrence in the hills of North China. Lieut. Doveton told me of one he experienced in the hills 30 miles north of Peking, when the stones were as large as hens' eggs. This seems almost incredible, unless he meant eggs laid by Indian hens!

Our ponies, who had been having rather poor food, now got oats—a crop much grown in the mountain districts of Shan-hsi. Potatoes were plentiful—the same variety as our own. In respect to the potato, Sir Clements Markham stated that it was "through Warren Hastings' forethought and care in considering the nature of the country in Tibet and to the eastward, that the potato was introduced about 120 years ago. And it has undoubtedly spread from the valley of Lhasa into Ssŭ-ch'uan." Now the potato is grown all over the hilly country of North, and in many parts of Central, China, especially in Shan-hsi and the K'ou-wai. It is mentioned by many travellers, and is now a staple food of these people. Shan-hsi is one of the earliest civilized parts of China long before Warren Hastings' day.

Are we, then, to believe that the Chinese only began to cultivate the potato a little over a hundred years ago? It is quite possible, for it is stated that opium has not been grown much longer. These examples are of interest, as, if correct, they tend to show how quickly new

plants and habits can be introduced and spread over this vast empire. Excellent grapes are grown, from which a palatable wine is made.

On August 30, we climbed the Hua-yeh-ling (pass, 7500 feet), and reaching the top, the holy place of pilgrimage, with its red and white, golden and yellow-roofed temples lay, silent and beautiful, in a narrow well-wooded valley, at our feet. On the pass we met several Mongols with their ponies hurrying back to their native soil, their pilgrimage completed. One Mongol was prostrating himself full length on the ground nine times, making his last Ke-t'ou to the P'u-sa-t'ing, the principal temple of this Mongol Mecca. That night we took up our abode in one of the temples, at an elevation of 6000 feet above sea-level, in comfortable quarters surrounded by the Wu-t'ai, or Five Peaks. Though it may appear remarkable to those acquainted with the usual condition of things in lama temples, our rooms were clean and free from uninvited guests.

Wu-t'ai is an ideal spot in which to pass the hot, enervating months of July and August. Here the temperature stood at 60° in the shade at noon on a bright sunshiny day, while a few miles down the valley 70° could be got; and to those who prefer the cold, a climb to the top of any of the five surrounding peaks will give as low as 45° to 48° Fahr. in the shade, even at that season of the year (August). We made a plan on a scale of 6 inches = 1 mile of this the most famous Buddhist, or rather, ought we to say, lama, place of pilgrimage (there are several others of the same name in China, notably in North Ho-nan and in North-East Hu-pei, to which Manifold has referred, but these are mainly for orthodox Buddhists), the execution of which caused some consternation among the priests, who, having only recently heard of the arrival of our mission at Lhasa, wondered whether we might not be the advanced guard of a similar expedition to their retreat.

On September 1 we were awakened at 3 a.m. by a deafening noise of drums, gongs, and horns calling the priests to early prayer. Once started, prayers continue on and off till noon. Then a meal (they had previously partaken of a light meal of small millet soup about 8 a.m.) and sleep till 4 p.m., after which prayers again commence and continue till dark, when the evening meal is eaten.

Prayers consist mainly in chanting the Buddhist liturgy, turning prayer-wheels of many shapes and sizes, and walking at a fast pace round and round the central building, always in the direction of the hands of a clock—this, I suppose, by way of a constitutional!

About 8.15 a.m., on September 1, we started to ascend the Chung-t'ai, or central terrace, which lies next to the Pei-t'ai, or northern one, on the west side. We reached the top at noon, after a pretty steep climb over grass-covered bare slopes. The summit is a water-logged plateau or terrace of about 400 to 600 yards in diameter. This is covered with the ruins of what must once have been a very fine temple, built of solid

blocks of granite and limestone. Carved dragons and lions and obelisks lie strewn about. The bulk of the remains have been collected into a single structure 40 × 15 × 10 feet. Inside this are three vaulted chambers with cast-iron images of Buddha. Two slate tablets let into the wall on the west of the entrance give a history of the temple and the names of those who, by subscribing to do this work, hoped to earn merit.

In front of this rough structure, on the south side and in the middle of what was once evidently the central courtyard of the temple, is a pagoda, 30 feet high, of carved stone. Further south, about 100 yards distant, are the remains of a masonry terrace and pagoda. From this spot a magnificent panoramic view is obtained of the other four "t'ai," and the valleys beyond; and here, no doubt, the emperors and other distinguished pilgrims have sat when visiting—as they have done for over a thousand years—this mountain summit.

According to Rockhill, these temples on the summit of Chung-t'ai were built in A.D. 581–601. The three travellers who have left records of the height of the Pei-t'ai, or north terrace, all give approximately 10,000 feet. We made the Chung-t'ai 9600 feet, and computed that the Pei-t'ai was 400 feet to 500 feet higher. With a temperature of 48° in the shade, water boiled at 195·6°. We could see no other peak higher than the Pei-t'ai. As already mentioned, the highest peak of the Hsiao-wu-t'ai Shan is certainly under 10,000 feet, and I am inclined to believe that the Hing-an mountain range, of which the Greater and Lesser Wu-t'ai might be called southern extremities, does not contain a single peak over 10,100 feet above sea-level; moreover, in all probability, no peak of the Hing-an, lying north of the Lesser Wu-t'ai, reaches 7000 feet. The next highest mountain in Shan-hsi to the Greater Wu-t'ai, is a curiously shaped one with three peaks lying south-east by east of the Chung-t'ai, and about 30 miles distant. We were unable to discern the mountain mentioned by Edkins, as lying to the north-east, and which he says is higher than Wu-t'ai.

The rocks are mainly granite and sandstone, with an admixture of quartz and conglomerate. Excellent coal comes from Ching-ho-wa, 35 miles to south-east.

Oats are grown within 1500 feet of the top, *i.e.* at an elevation of 8000 feet, and rhubarb at 7000 feet. The whole hillside is cultivated, giving a kind of chess-board appearance. There is less terracing than in other parts of China. A remarkable thing (considering the limited area of these plateaux) is the large amount of water at 9500 feet, and that in spite of an extremely dry year. At 8000 feet there were springs of water. Scarcity of water along the routes had resulted in a large falling off in the number of Mongol pilgrims, consequently, as the Head Lama carefully explained to us, there was a heavy shortage in the amount of contributions. Pilgrims give both in cash (anything from

10s. to £100) and in presents of appurtenances for the temples. The chief industry of the place is the making of copper and bronze idols. It may be interesting to mention that the Dalai Lama was then in Urga, and the priests said that he would never return to Lhasa as another had been appointed in his stead. Evidence of the decay of the lama religion is the absence of any Mongols approaching the shrine by prostrating themselves at full length on the ground, as mentioned by Edkins years ago. Even the few who do prostrate themselves for a number of hours daily, do so with extraneous assistance in the shape of smooth sloping boards, and pads for the hands, knees and forehead.

A TYPICAL ROAD IN THE MOUNTAINS OF NORTHERN CHINA.

It is small merit such pilgrims will store up for themselves, though the exercise is no doubt conducive to a good appetite and digestion.

Rockhill speaks of 360 temples in the valley. In 1905, omitting very small insignificant places, there were only 107. Of this number 30 are at Wu-t'ai itself (of these only five are called "Ta," or Great); the remainder are scattered along the valleys through which the main route from Pao-ting Fu leads. There is a fine pagoda in a prominent situation; at the time of our visit it was undergoing repairs, the expenses being met by a local merchant desirous of piling up merit. It is 70 feet high. Two splendid stone lions are all that remain intact of the Emperor Kang-hsi's picturesque summer residence, now a mass of ruins overgrown with foliage and grass. As at Je-ho, so at Wu-t'ai, the decay of lamaism is everywhere in evidence. A Japanese called on the chief lama during the time of our visit.

On September 5 we said good-bye to our kind Mongol friends, and made our way to Wu-t'ai Hsien (the chief town of the district);

thence we proceeded by unsurveyed routes to the Pei-han railway at Cheng-ting.

The country was wild and rugged. The main points worthy of remark are, the perseverance with which the Chinese carried coal for distances up to 50 miles from the mines over the most heart-breaking tracks imaginable; the steepness (30°) of the descent from the Hei-shan-kuan (4800-feet pass); the broken character of the hills, which were nearly bare of trees; the labour and skill with which the people cultivated the steep mountain-sides to a height of 8000 feet above sea-level, the fertility of the loess, and the almost total absence of game and small birds.

The Central China Region.

In 1903 and 1904, Lieut.-Colonel Manifold had charge of the expeditions devoted to gathering information concerning the geographical and commercial aspects of the western half of the great Central China region. Lieut.-Colonel Manifold gave an account of his explorations in two interesting papers read before this Society, mainly devoted to the province of Ssu-ch'uan, which is held to be, no doubt with reason, one of the finest fields for future commercial enterprise. Distance, ever prone to lend enchantment to the geographical horizon, has always had its attraction for explorers. Thus it happens that the remoter regions of the Chinese Empire have received rather more than their fair share of attention. In our efforts to learn as much as possible about these distant lands, thousands of miles from the sea-coast, we have somewhat overlooked those not less geographically interesting and commercially profitable, though little-known, districts within easy reach of ocean-going steamers.

Looking through the *Journals* of the Royal Geographical Society for the last fourteen years (1893 to 1906), out of twenty-five papers devoted to the Chinese Empire (excluding Chinese Turkestan and Tibet), there appear to be only three dealing with Northern China, and none at all relating to the eastern portion of the Central China region. In the number of the *Journal* for November, 1898, is a useful compilation by Mr. G. Chisholm dealing with China as a whole, but it requires bringing up to date.

This is an astonishing fact when we remember the importance of these regions, and, until quite recently, the lack of accurate geographical information concerning them, so that even now there are quite large areas which are scarcely explored.

I cannot do more here than mention the extensive explorations done in 1903–04 by Lieut. Webster in North Ho-nan; along the Yellow river; in the hills in the triangle Ho-nan Fu, Lung-chü-hai, Nan-yang Fu; in south-east Ho-nan, and north Ngan-hui. He surveyed in some six to seven months between 2000 and 3000 miles, with the assistance of

two surveyors who generally followed different routes to Webster's. The Peking Syndicate's surveys, executed by Survey of India men, formed the basis of the sheet of Ho-nan province, and Webster's work was mainly responsible for the rest. The hills in the triangle above mentioned had never been explored by a foreigner before. Those north of the Lo-Ho (that historical ground of ancient China) were explored by Manifold and Hunter in 1901–02.

If it is in a country with a growing population that we must look for the increase of trade, then may we safely turn our commercial attention to the eastern section of Central China in general, and to Ngan-hui in particular. Devastated during the Tai-p'ing rebellion, it is recovering rapidly, and its population is increasing by leaps and bounds.

The 'Encyclopedia Britannica' translates its characters, "Peace and Plenty" (a doubtful meaning), and justly calls it "one of the most productive provinces of China." Richthofen says of it, "The exuberant fertility of the soil in the lower portions of the province" (and I would add in the central also—A. W.) "is not excelled by anything I have seen in temperate climates. No expense has therefore been spared in protecting the lowlands by embankments, and introducing a perfect" (I would rather say nearly perfect—A. W.) "system of irrigation. Both deserve the highest admiration."

It was the difficulty of learning anything about Ngan-hui province (except along the banks of its main artery, the Yang-tzu Chiang and the country contiguous to it) that first guided my steps in that direction.

As with Outer Chih-li, so with Ngan-hui—with the exception of a page or two in the late Baron von Richthofen's "Letters," and a short paper in the reports of the Chinese Imperial Customs, we have to turn to the French and German languages for information available to the public. As so often happens, the French were before us in this matter, and Père Havret's little work, though somewhat out of date (1890–93), is of great value. It is for this reason, and that they are among our most recent travels in China, that I thought it might be of interest to tell something of a territory not much heard of in this country, although, strictly speaking, only about one-third of it is included in the term "Northern China."

First, a few figures to give some idea of the size and population of Ngan-hui province. Greatest length, 350 miles; greatest breadth, 320 miles; which gives an area of 54,000 square miles—that is, about the size of England, the state of New York, or Uganda. Population, 24,000,000, equal to Austria, or to the Royal Niger Company's territory plus the Niger Protectorate, and only some eight millions less than that of England and Wales. This gives a density of about 440 to the square mile, equal to that of Belgium. The above are the official figures, but I incline to think they may be overestimated, though every year there is a steady increase both by birthrate and immigration.

The name Ngan-hui (the *ng* at the beginning is an attempt to give the peculiar nasal sound to the word) is derived from its two most important cities, Ngan-ching (the capital) and Hui-chou, the chief city south of the Yangtzu-Chiang. The words signify "Peace and Excellence," which might truthfully be rendered "Peaceful Beauty," if applied to the southern half of the province.

The province is split up conveniently and naturally by the rivers Huai and Yang-tzu into three parts, each with its marked characteristics. North of the Huai is level plain, with nothing but a few isolated mounds to break the monotony. It is, in fact, a continuation of the Great Plain, to which it belongs, together with its icy dust-laden blasts, its crowded though poor population, its carts and its mules (camel caravans and cart traffic are, on the northern bank of the Huai, giving place to coolie transport and wheelbarrows south of it), and its scanty flora and fauna. The central portion, lying between the Huai and the Yang-tzu, is half mountain, half plain, studded with lakes and low-lying, inundated tracts. The population is less dense than in the northern region. The part south of the Yang-tzu differs altogether from the other two. It is mountainous, with a comparatively wealthy and fairly dense population.

Though there are as yet no railways, and the roads are poor, intercommunication between these three regions and the neighbouring provinces is easy, owing to the numerous waterways. Thus Ngan-hui unites in one province the main characteristics of North and Central China, as well as the coastal country of Kiang-su and Chê-kiang.

Geologically, the northern region is, as already stated, alluvial soil like the Great Plain, with occasional patches of loess in the valleys between the outlying spurs of the K'un-lün, which are composed of sandstone, granite, and marble. The branches of these spurs extend eastwards as far as the Hung-ch'ih lake. South of the Yang-tzu we have the Nan-shan range, mainly composed of granite, limestone, and schist, with alluvial soil in the valley bottoms, but no loess. I have been in Japan, and was struck by the general similarity in appearance of the scenery of southern Ngan-hui and Japan. Richthofen states that the geological formation of the two countries is similar. If we except the immediate neighbourhood of Wuhu, a favourite centre for cold-weather shooting among the foreigners residing in the lower Yang-tzu basin, very few people, except missionaries, have travelled in the south and most interesting part of the province, except along the borders of the Yang-tzu river. Of those who have, I can only find records in English of Brawn in 1794, Fortune in 1848, Richthofen in 1871, though, of course, there may be others.

Previous to our visit, with the exception of two railway reconnaissance surveys, none of it had been surveyed—at least, there are no

published records of any—and the maps (the best of which were the Chinese and Père Havret's based on it*) were very faulty indeed.

There is little of special interest to tell concerning the country north of the Huai. It is densely populated by poor, though hard-working farmers, who do not find time for much else. The conditions in this part are almost identical with those of the rest of the Great Plain, except that, partly for purposes of protection against robbers, and partly against floods, the villages are raised above the level of the ground, on little islands, so to speak, with often a mud wall and moat.

In the northern part of the central belt, the aspect of the country is very like that of Southern and Eastern Mongolia—long, gradual undulating slopes, looking like immense ocean waves; as each one is

A FREQUENT SIGHT IN CENTRAL NGAN-HUI.

breasted, another appears about the same distance ahead. The soil is poor, and the population not dense.

In the whole of the region north of the Yang-tzu there is an almost complete absence of timber, which must have a very high value for it to pay to carry tree-trunks from the Po-yang Lake to Lü-chou Fu by water, and thence in wheelbarrows to Fêng-yang Fu, in Northern Ngan-hui, a distance of 80 miles.

To see the wheelbarrow men (many of them intelligent farmers and traders out of present employment) heaving, pushing, and staggering along with their heavy and often unwieldy loads is indeed a lesson to those who believe in the theory that only the fittest survive, and who are accustomed to European and American methods of conveying goods. Yet these men are nearly all opium-smokers. No sooner is their day's journey ended, their evening meal of rice and a bowl of tea or soup consumed, than they hie them to the opium dens, and there pass the

* There is another map by A. Pierre, 'Province du Ngan-hoei,' which I have failed to obtain. It is not among the collection of the R.G.S.

night, laughing, talking, smoking, and gambling. They are up again next morning and well on their road by 7 a.m. Who that has seen these men toiling along the atrocious roads, up and down hill (ay, even steps!), or watched boatmen circumventing a rapid, will be certain that all opium-takers are lost creatures? If they are, who would not try and do something to save such splendid specimens of humanity?

The Huai Ho.

One of the most interesting geographical features of North Ngan-hui is the Huai river. Hitherto it seems to have received but slight attention. No foreign gunboat has ploughed its waters; only one steam-launch had, at the time of our sail on it, visited its ports. Why is this? The reason is simple—because, through neglect, the Grand Canal from Yang-chou Fu to Ch'ing-chiang-p'u, and the passage from there through the Hung-ch'ih lake, have been allowed to silt up. This is a pity, because once through this latter and in the Huai proper, the depth and width and other conditions of the river are such that river steamers drawing 6 feet could proceed to Ch'eng-yang-kuan, while a smaller type of vessel could reach such places as Wu-lung-chi.

Navigation by steam-launches, and specially built river steamers of a smaller type than those which go from Hankow to Ichang, would find no difficulty in reaching Ch'eng-yang-kuan once in the Huai river itself. Even under present conditions the lowest water in the Hung-ch'ih lake is 3 feet, and highest 10 feet. In width the Huai varies from 100 to 500 yards.

It would be worth while to survey the Grand Canal and the Hung-ch'ih lake with this object in view. Best of all would it be to construct a fresh canal, or improve the existing waterway, from the Huai *before* it enters the lake to the Grand canal about 30 miles above Yang-Chou Fu.

The traffic on the Huai is immense. Ch'eng-yang-kuan is a thriving, bustling mart. According to Chinese sayings, fifty waterways meet about here; but be that as it may, it receives one important tributary, the Sha-Ho, which gives access to the inland port of Chou-chia-k'ou, the most important mart in Ho-nan south of the Yellow river.

Lü-chou Fu is an ancient city, whose people pride themselves on their literary attainments. This is the country and home of the Li family, of whom Li Hung-chang is the best remembered. The great statesman's grave is a picturesque but simple affair by the side of a pond, near the banks of the canal leading from the city to the Ch'ao Hu (lake). Near by are the remains of the grave of an even more celebrated (from a Chinese standpoint) statesman, who lived and was buried here about five hundred years ago. I wonder will the great Li's headstones be in a similar condition five hundred years hence? The older grave receives now no care at all.

Lü-chou is undergoing a great revival, and shows signs of becoming a leading city in the new China that is making. It was in the college here that I was introduced to several fine Chinese lads, whom, in the twilight, one might have taken for English public schoolboys, such was their garb and nonchalant demeanour! In this city, and also in Ngan-ching the capital, we were much struck by the rapid strides which education had made along modern lines. Splendid schools and hospitals are already in full operation, and the thirst for up-to-date knowledge is apparent on every hand. There is regular steam-launch communication between Lü-chou and the treaty post of Wuhu, 100 miles distant by the water route. Along this route small river-steamers might ply, provided some improvements were effected in the approaches to the city of Lü-chou from the lake. Between the lake and Wuhu there is a fine broad waterway of sufficient depth. There is a great traffic carried on along this route.

From Lü-chou the waterway leads one into the Ch'ao Hu, a splendid sheet of water. The north and west shores are flat. Picturesque islands are dotted about here and there, and the scenery along the southern shore is pretty, though the hills are too bare. What they might be with proper afforestation can be seen south of the Yangtzu.

In Ngan-hui, north of the Yangtzu, deforestation reigns supreme, but in Southern Ngan-hui afforestation seems to really have taken root. There the trees got a start in the years following the T'ai-ping rebellion, when there were scarcely any people left to cut them and the undergrowth. While on the subject, I should mention that afforestation thrives also in Hu-nan province, whose thrifty population is too sensible to destroy the goose with the golden eggs.

A curious feature of the Ch'ao Hu is the method of fertilization along the lake-shores which I have not seen elsewhere in my travels in China, nor is it mentioned in Père Havret's book, though he speaks of most things. Unfortunately, owing to adverse weather, contrary winds, and tempests and cold, I was unable to do more than note this matter. To illustrate my meaning, I cannot do better than quote what I find in my diary for that day, bearing in mind that we had spent the previous day in beating against the wind, with the result that we gained barely a mile along our course.

"*November* 3, 1905.—During the night it clouded over (min. temp. in boat with doors shut, 40° Fahr.) and came on to blow hard from the north-east, just the direction we want to go—result, we are obliged to stay where we are, a rather undesirable spot a mile east of the Chung-miao promontory, with nothing to do. Some duck too wild to approach. If one wanders more than 100 yards on either side, one's nostrils are assailed by manure-pits, not made from the usual human ordure, but by pouring the water of the lake into sand-holes and allowing it to evaporate. Result, much smell and a green deposit, the colour of verdigris, and

called 'cha-ts'ao.' The manure itself looks like a dark-green mud. The shores of the lake are red conglomerate formations of red sand and clay, and very hard. Heavily laden cargo-boats can sail, but not the lighter ones. Very few fish in this lake, but the Chinese say the Pai or Po Hu further south is full of them (Note—this lake has never been explored by foreigners). But no one seems to know anything, and the dialect spoken here is perfectly unintelligible. The boatmen, too, are a lazy lot, and cannot be got to respond to inquiries. Extracting information is like drawing blood from a stone. Blew all day hard from the north-east. Very cold. Progress *nil*."

Passing to Southern Ngan-hui, the district all around Wu-hu for many miles is a network of waterways, embankments, and rice-fields. This is one of the best shooting districts in the Yang-tzu valley, though there is plenty of excellent pheasant-shooting almost anywhere in Southern Ngan-hui.

Even small-game shooting in China is sometimes attended with all the exciting scenes more properly belonging to the chase of sterner game. Every one has read of the unfortunate shooting incident which happened last year near Ngan-ching, to the American admiral on the China station. Well, the first we heard of it was at Wu-hu, and so, naturally, we were inclined to be extremely careful when the local Celestials and the pheasants got too much in the same line of fire.

All went well till one day, at Ning-kuo Fu, my companion and I were out together, and both shot at (and missed or hit, I cannot remember) a fine cock pheasant. Immediately after the shots, I saw a Chinese man running towards us from the left front, and not in the line of fire of the bird, followed by two or three others. He showed a little spot of blood on his lower lip, and, opening his mouth, a very dirty and crooked lot of teeth. He declared he had been hit, and half his teeth knocked out. We argued for a bit, the spectators meanwhile increasing in numbers. At last, seeing he had about two to one the best of us in evidence and ten to one in numbers, I put my hand in my pocket and was deliberating how much to start with, when a man behind me intervened, saying to me, "Don't you be a fool. He was never hit by the shot; he hit himself with his hoe-handle when he heard the shots close in front of him." Then, turning to the culprit, he said, "You be off; you know you are only lying!"

This story serves to illustrate two points: one common to all China, viz. the adaptability of the Chinese nature to circumstances when possible gain is in view; and secondly, that in Southern Ngan-hui, owing to the immense immigration of people from every quarter of China to make up the number who were there before the T'ai-p'ings came, there is a diversity of interests, one man's hand being, so to speak, against all; so that, while on one bank of the river you might be stoned, on the other you would very likely find protection.

Talking of the T'ai-p'ings reminds me that the author of a very popular 'Life of Gordon' told me that somebody had told him that Gordon had said that when he fought for the Chinese Government against the T'ai-p'ings he fought on the wrong side. I do not believe Gordon said any such thing; he fought on the only side he could—on that of law and order. Any one who has walked, as I have, for days and weeks in Southern Ngan-hui, through towns, villages, and farms laid waste by the ruthless band of the T'ai-p'ing rebels, will ever rejoice that Gordon lent his wonderful power in assisting to overcome them. His memory is revered to this day: I have received on several occasions unlooked-for

THE GRAVE OF ONE OF CHINA'S GREATEST STATESMEN, LI HUNG-CHANG.

kindness in the interior of China, for no other reason than that I belonged to the same army as Gordon.

It is when we come to Southern Ngan-hui that we enter a country having certain attributes peculiarly its own. It again divides into two parts—the flat rice-growing country around Wu-hu and bordering the Yang-tzu, and the mountainous interior. In the former one meets with the same characteristics as in other similar localities where the people by growing rice eke out a monotonous life in the struggle for existence. But once inland and all is changed. Two things are immediately apparent. Here were once the homes of an artistic and opulent people, and here also the hand of the destroyer has laid waste

the land. The prefecture of Hui-chou was formerly inhabited by a clever industrious people, celebrated throughout China as merchants and bankers.

Père Havret thus admirably sums up their good qualities: "Hardi et entreprenant dans le négoce, le peuple de Hoei-tcheou laisse aux femmes la garde de ses maisons, il afferme à des étrangers la culture de ses vallées, puis il s'en va au loin chercher une future que la terre lui refuserait. Cette remarquable aptitude des habitants du Hoei-tcheou est consacrée par ce proverbe que toute la Chine connait 'Wu Hoei pu-ch'eng-shih'"—that is to say, "Business cannot be carried on without the people of Hui-chou."

The truth of the above saying is at once seen in the better dwelling-houses, the splendid ancestral halls and memorial arches, with their beautiful architectural designs and sculpture; the number and quality of the bridges; the excellent condition of the roads (a rare thing in China); and the better clothes of the people. Of course only a small proportion of the inhabitants of pre-Tai-p'ing days remain, and one notices quickly the difference between them and the more recent immigrants from Hu-pei, Kiang-si, and neighbouring provinces.

This prefecture is full of interest to the artist, the botanist, and the lover of natural history.

Southern Ngan-hui is fast being repeopled. The inhabitants are very enlightened as Chinese in the interior go, and are anxious for all modern and Western improvements. Even in religious matters they have shown much spirit—some villages having, of their own free will, destroyed their idols. A couple of years ago the students attending the examinations for degrees, attributing their backwardness and ignorance to the bad influence of their idols, destroyed the statues of the eighteen lohan or saints which line the right bank of the river opposite the Hui-chou city. They knocked all the heads off except one.

We found existing maps of Southern Ngan-hui very inaccurate. Altogether in South Ho-nan and Ngan-hui we surveyed 3600 miles of routes and made thirty-one plans of cities and towns in ninety-seven days, including halts.

The mountains of southern Ngan-hui have been very little explored. The higher peaks average over 6000 feet, are forest-clad and exceedingly beautiful. There are many birds, and excellent pheasant-shooting almost everywhere.

Chinese Ink.—One of the chief industries of Hui-chou prefecture is the manufacture of Chinese or, as we wrongly call it, Indian ink. The centre of production is Hsiu-ning, a district town 25 miles west of Hui-chou city. Here is made the supply of ink for the whole empire, indeed for the whole world, if ink of the first quality be required. The firm of Hu K'ai-Wen is world-renowned, and no ink is considered good without this name being on it.

Chinese ink is of varying quality, ranging from eightpence to seven or eight sovereigns a pound, containing from thirty to thirty-two small sticks. I cannot describe here all the finesse of its manufacture, but much depends upon the quality of oil and lampblack.

We watched the men at work in dark, confined rooms at the back of the small shops—much like similar factories in London two hundred years ago—and came to the conclusion that here lay a mine of wealth to the first who should lay down suitable machinery to carry on this industry on modern lines. From 20 to 160 sheets of goldleaf are used per pound, and great artistic taste is exhibited in the various designs. Models of the lohan, or saints, and of temples and mountain scenery are made. Presentation cases for export are now obtainable in Shanghai. Each case contains two boxes, each of which has two beautifully lacquered inner cases. A box contains eight slabs of ink—making a total of sixty-four slabs for $64 or $65 (say, £6 10s.), well worth the money, as the ink does not perish by keeping.

Sha-shih to Wan Hsien.

After completing our explorations in Ngan-hui and Hu-pei provinces, we wished to prove by actual examination the possibilities of the route through northern Hu-nan to Wan Hsien on the Yang-tzu (above the gorges) for a railway.

We examined the only available maps, and from previous experience in similar country, made our calculations as to the number of days the journey would occupy from Sha-shih *viâ* Li Chou and Tzu-li to Wan Hsien. We made it—allowing a liberal margin—400 miles, which at 20 miles a day made twenty days.

The distance we travelled (and we went by the shortest route) was 612 miles (all of which we surveyed), and the number of days thirty-three, exclusive of two days in halts, that is at the rate of 18½ miles a day. So much for existing maps of the mountainous districts of the Central China region. Our route lay up the river from Tzu-li to Shih-nan *viâ* Ho-feng, and on to Wan Hsien; almost a bee-line on the map, but it proved one of the most tortuous, roundabout pathways possible to imagine.

We formed the opinion that the particular route was very unlikely ever to be selected for a railway, and that the "chord" line will never be made in our time. The only possible route would be *viâ* the following towns: Tzu-li, Yung-ting, and Lai-fêng to Shih-nan.

So we arrive at this conclusion, that if there is to be a railway to connect the upper and lower navigable Yangtzu sections, it must be more or less, as Lieut.-Colonel Manifold has pointed out in his admirable paper, along the north bank.

There is no published account of explorations in the mountains between the Yuan and Ch'ing-Chiang rivers east of 109° E. long., and

so far as we could ascertain no foreigner (not even a missionary) had ever travelled by the routes we followed from Tzu-li to Shih-nan Fu, and from there to Wan Hsien.

Our work dovetails into my first journey through Hu-nan in pre-Boxer days, and Manifold's and Hunter's work south of the Yangtzu.

The country is wild, rugged, and beautiful. Between Tzu-li and Shih-nan the population is, on the whole, sparse; though there are several small densely peopled and cultivated valleys. Cultivation, as in Ssŭ-ch'uan and other parts of the hill country of China, is carried nearly to the tops of the mountains.

Underground rivers are frequent. In one place I came upon a dirty yellow stream of water flowing from the cave-like recesses of a dark ravine. Ascending this for 300 feet, I found a broad alluvial valley covered with grass, and with several boats lying high and dry on the mud. The only sign of water was a fast-flowing stream (also muddy, but clearer than below) which disappeared suddenly into a hole in the ground, near the head of the ravine up which I had come. Near by was a roadside shrine. The Chinese state that every rainy season these elevated valleys (they average 1500 feet above sea-level) become lakes, the water being often 30 to 50 feet deep, and the only means of communication is by boats. Numbers of cattle and water-buffalo were grazing. The temperature was low, only 48° at midday on a fine but hazy day, March 6. Elsewhere I saw a number of Chinese men and boys engaged in extracting, with small hand-nets, the fish from a pool, which was evidently the last remaining water of one of these lakes.

Our road lay for the most part through deep, narrow gorges with perpendicular cliffs often 2000 feet above the river bed. The undergrowth was very thick and varied in character. Birds were numerous. A section of the route would show many steep ascents and descents of over 3000 feet, sometimes two in one day. The highest passes were about 6000 feet above the level, and the loftiest peaks 7000 to 8000 feet.

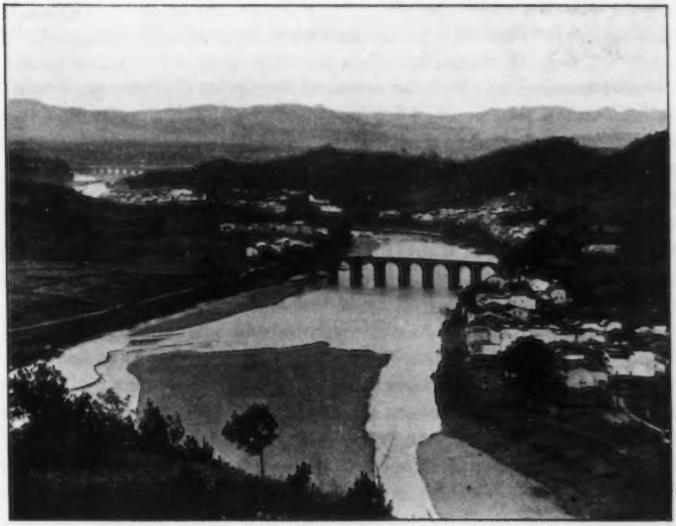
At T'ien-ch'iao, 6 miles south-west of Shih-nan Fu, is a natural bridge under which the river passes. This phenomenon is said to have been due to an earthquake in the reign of Tao-Kuang (1821–1851). Good coal is mined close by; the whole valley hereabouts is limestone and coal; the scenery beautiful.

The Geography of Railways.

Northern China.

This subject has, during my sojourn in the Far East, received more attention than any other. It is worn pretty well threadbare; but I would ask forbearance while I say a few words mainly on behalf of the Chinese. They do not get a fair chance. The bulk of them want railways, want

mines, want every kind of modern and Western invention and improvement. But they must be allowed breathing time. In 1895, and again in 1900, they were hit below the belt, and, like an untrained boxer, they have scarcely had time to regain their equilibrium. Who that has seen them travelling by train in those luxurious (?) third-class carriages will deny that they must have a perfect passion for travelling? See their poor women pushing and shoving to get seats in the train—for all the world like people rushing for front seats at a popular play. Surely such things speak for themselves. Gold, silver, copper, tin, coal, *et hoc genus omne*, lie buried beneath the surface of their splendid inheritance, and they are as keen to get possession of them at the lowest possible



THE BEAUTIFUL VALLEY OF HUI-CHOU PREFECTURE, SOUTHERN NGAN-HUI.

capital outlay as were ever the most astute of South African companies. But as yet they don't quite understand the business. Why should they? They have no London or New York Stock Exchanges to teach them. During the Russo-Japanese war they got no respite; but they learned something, and now they are just beginning to awake as from a foolish dream. Like most revolutions, the Boxer one of 1900 produced the man for the occasion, in the person of Yuan Shih-k'ai, a strong man, knowing his own people's peculiarities well, but not fully versed in the vagaries of the foreign capitalist and concessionnaire. So he said, "I will manage my own people myself, but I will collect around me as advisers men who have been trained and taught by the countries which possess the

greatest reputation for go-ahead methods; and while my poor people are learning something of western knowledge, I will get these clever men to help me to stave off the rush of the foreigner with his uncontrollable fierceness."

The chief of these men is Tong Shao-yi. Now, no one who has met this clever, enlightened, polished Chinese gentleman will be so foolish as to suppose that H. E. Tong believes a railway can be built from Hankow to Ch'eng-tu or Canton without the assistance of foreign capital and brains. Unlike their predecessors, Li Hung-chang and Jung Lu, Yuan, Tong and their friends really know and understand something of Western civilization, and they realize that if these immense railway and mining enterprises are to be undertaken, it can only be with the assistance of foreign nations. They also know that the working of railways and mines in China by purely foreign-controlled companies engenders—as indeed it would in England or America, were our railways and mines to be managed solely by Chinese—so much ill feeling, and calls for so much meddling by foreign governments in Chinese internal affairs, that the people are—and in my opinion quite justifiably — anxious to control them themselves. But this does not mean that, provided they can get it on their own terms, they are adverse to use foreign capital or foreign engineering skill and material in the fulness of time. China is moving, but the Chinese do hate, above everything else in the world, being hustled. They lead the strenuous simple life, but they like to do it quietly and slowly as suits an Asiatic people who, after all, are only what their climate and surroundings have made them. We must grasp these facts, not as we hitherto have done, only in connection with the building of fleets and the making of armies, but with respect to education and economic and industrial enterprise. They want—and who in justice will deny their right to it?—the lion's share of the industrial development of their own country. They mean to learn all about Western civilization, but to apply it in their own time and way for their own people. To tell where and how railways should be made is the business of the engineer and the capitalist. I will only say, therefore, that the Chinese people, as soon as they understand what railways mean, want them and appreciate them. During our recent wanderings we were often welcomed by the people, and by some officials too, as "T'ieh-lu Kuan" (railway officials). We had conversations with many Chinese in the interior, and found them anxious for the extension of the railway, the telegraph, and the post office to their towns and villages. In my opinion the Chinese engineer who, without foreign assistance, will build a line of rail in the best and most economical way from Hankow to Ch'eng-tu, or through the Nan-k'ou pass, or Hün Ho valley to Kalgan, is not yet born. That such lines are desirable no one who has watched the transit of passengers and merchandize through the Yang-tzu gorges, or over Chinese

mountain roads, can doubt; and that they will be costly we may be sure. But whether these, or any other lines, be built with foreign capital or with Chinese, or by both combined (as is most probable), the Chinese can never accuse the British of a dog-in-the-manger policy. It is our explorers and our surveyors who have pioneered the exploration of possible routes by land and water—made maps of their mining districts, plans of their mineral deposits and cities, charts of their coasts and rivers—in a word, discovered for them their natural assets, and though for a time some of the results may be regarded as confidential, sooner or later they become available for the Chinese, when ready to make use of them, and it is they—and rightly so—who will benefit.

There are those perhaps who may regard expenditure incurred in doing for the Chinese what they should do for themselves as money and labour wasted. I find myself unable to subscribe to such a creed. A little open-handed liberality is appreciated by any one, but more particularly so by the Chinese, among whose virtues hospitality and liberality should most certainly be included. I have never found them niggardly. True, they will spend hours bargaining over a single cash ($\frac{1}{35}$ of a penny), but once the bargain is struck they stick to it and do not grudge a few extra cash over a side issue. They have something of the Americans in their disposition. If they get money easily and quickly they spend it in the same way.

Railway construction has been more successful and rapid in Northern China than elsewhere in the Empire, and we can now proceed by rail from London to Hankow (600 miles inland from Shanghai), a distance of 7500 miles, except for the crossing of the English channel. The branch to Kalgan has reached the mouth of the Nan-k'ou pass, where I am afraid it is likely to remain for a rather long time. This section was built by Chinese engineers, but it will take a very clever engineer to make a good job of the ascent of the pass—a rise of 1400 feet in 12 to 13 miles in a very confined gorge, so that the gradient is not likely to be less than 1 in 65, even allowing for 18 to 20 miles of line. We have surveyed the gorges of the Hün Ho where it flows from the Hsüan-hua plateau on to the Chih-li plain, and it is an open question whether a railway to Kalgan might not more profitably go by this route, which is considerably shorter. No doubt the initial expenditure would be much greater, but once made, the working cost would be a good deal less, as the sudden ascent of the Nan-k'ou pass would be avoided. There is abundance of good coal along the Hun Ho valley route, and of course no traffic would be lost, as little comes through the Nan-k'ou pass that does not come to Hsüan-hua first.

I understand that the reason for selecting the Nan k'ou route was that it would be easier to overcome the prejudices of the Chinese. But the day is quite past when the alignment of a railway in China should

be allowed to depend on the idiosyncrasies of the local inhabitants. There are now far too many enlightened Chinese for that sort of thing. Of course these objections are often merely a cloak for gain, and the railway engineers prefer to go round and take up cheaper ground than pay the exorbitant sums demanded for ground along the best alignment. But surely the time has come when the leaders of 400 million willing workers and really intelligent people should see to it that the future prospects of their country are not sacrificed to the grasping selfishness of a minority of the present generation.

Railway construction in the loess is not easy, but once the metre-gauge line from the Pei-han railway at Chêng-ting Fu to T'ai-yuan Fu is completed, the unexplored recesses of Western Shan-hsi and Eastern Shen-hsi will be brought within easy range, and a shooting trip to the Alashan will have lost half its charm and excitement. Railways, which are badly needed in North China, are one from Tientsin to Pao-ting Fu, and another from Tientsin to C'hi-nan Fu.

The Central China Region.

Of railways in the Central China Region there are almost none. The Pei-han connects it with the north, and a line is constructing from Shanghai to Nanking, but the bulk of the trade in this region is along a general north-west and south-east line, and *vice versâ*. There was much talk, when I was at Wuhu a year ago, about a line from that treaty port to Kuang-tê, on the Chê-kiang border, and the chief promoter was Lord Li, the adopted son and successor of the great Li Hung-chang. Such a line may be needed, and may pay, but more urgent ones are from Wuhu to Hui-chou Fu, and from P'u-k'ou (opposite Nanking) *viâ* Lü-chou Fu to Ch'eng-yang-kuan, and thence to K'ai-fêng and the Yellow river *viâ* Chou-chia-k'ou.

In connection with railways, I should like to see steps taken to improve the navigation of the Grand Canal between Yang-chou Fu and Ch'ing-chiang-p'u, and the construction of a short length of new canal (easily accomplished, as there are already waterways) to connect the Huai *before* it enters the Hung-ch'ih lake with the Grand Canal, and thus enable large boats and small river-steamers to navigate this splendid waterway right up to the Ch'eng-yang-kuan, and even beyond.

At the conclusion of a journey from Hankow to Bhamo, in Burma, in 1898–99, I drew up a memorandum concerning railway construction from Burma into China, in which, I remember, I strongly urged the desirability of stopping the work on the Mandalay to K'ün-lung line at Lashio, in order to provide funds for a line from Bhamo to T'eng-yüeh. This recommendation was supported by the acting engineer-in-chief in charge of railways in Burmah, and given effect to later by Lord Curzon. The late Mr. Litton, whose untimely death all geographers will lament, when consul at T'eng-yüeh, was of the same opinion as myself in regard

to this matter. I am glad to find a fresh and quite independent opinion in a report dated June, 1906, by Mr. Ottewill, who succeeded Mr. Litton as our consul in Western Yün-nan. He writes:—

"The remedy for the want of good communications is the building of a railway from Bhamo. . . . There is every chance that even a short line to T'eng-yüeh will pay its working expenses, and leave a margin for profits. . . ."

My contention was this: not that a railway from Burma to Ssŭ-ch'uan cannot be made, nor even that it should never be made, but that such a railway is before its time. First, we should look to see a line from Shanghai (or Hankow, at any rate) to Ssŭ-ch'uan,

VIEW LOOKING EAST FROM WALL OF HSIU-NING CITY.

because a railway line, or, indeed, half a dozen lines, from Ssŭ-ch'uan to Burma (or Tonking either, for that matter) will never divert to Rangoon or Haiphong a single waggon-load of goods that can go to Hankow or Shanghai. My reason for wishing to see a line to T'eng-yüeh quickly made was that it would tap nearly all the existing trade of Western Yün-nan, is on an old and well-established trade route, and that no particular harm is done even if, as may quite possibly be the case, it prove commercially impossible to push it further west. Possibly it might some day continue northwards. About this latter point, no doubt, Mr. E. C. Young, the most recent explorer in those regions, will be able to tell us something. In any case, it would be a feeder line to serve the Burma railways much in the same way as

do those which run up from the Bengal trunk line against the wall of the Nepalese State.

I agree with Mr. A. J. Sargent, who, writing in this Society's *Journal* of June, 1905, advocates caution in embarking on trans-continental lines through countries which do not afford much prospect of development along the line of rail. Short lines, to and fro between the best water-communication, are what are wanted in China before undertaking costly and possibly unremunerative trans-continental railways, unless it be to develop a newly acquired territory where no proper water-communication exists, and with a growing community at either end. Such a railway would be that to connect the Lower and Upper Yangtzu basins.

China is unlike North America in one respect—it does not lack population, and there is not the same amount of waste land and virgin forest to develop. Consequently there is not the same urgent necessity for through goods traffic as in America, where grain and lumber produced by a few people require to be transported quickly great distances to find a market. What the Chinese want is quicker and cheaper transit between important local centres. For instance, it is the short 29-miles section (from T'ang-ku to Tientsin) of the 500 miles of line between Peking and Hsin-min Fu which yields 75 per cent. of the returns on the imperial railways of North China.

What is true concerning railways in China is true of all enterprises. The Chinese cannot afford to spend a large sum of money all at once. Their capital is small, their realizable assets few. All their wealth lies buried in the future. They have to earn more before being able to spend more. Had concessionaries been less ambitious in their undertakings, things might have gone more smoothly. All the railways now constructed, or constructing, had small beginnings.

Railway and mining enterprise in China seems to me to have been too ambitious, too neglectful of the old adage about the tortoise and the hare. When first I began to be interested in things Chinese, eight or nine years ago, the two projects I heard most about were a railway from Peking to Hankow (over 700 miles long), and another from Mandalay to Ch'eng-tu, anything over 1500 miles in length. True, the former line is now a *fait accompli*. There were only two big bridges to construct and one short tunnel; the rest was level plain. It is a magnificent undertaking with its bridge over China's Sorrow, by means of which goods and passengers, that under the old *régime* would occupy a week or more and an army of men to convey, are now carried across in five minutes. But the history of the Pei-han is exceptional, and led to its quick—I had almost said hasty—completion. The alignment chosen in haste may yet prove not to have been the best.

A good deal of adverse criticism has been passed on the screw-pile bridge which for 3 kilometres spans the Yellow river. Though in

outward appearance a light and airy structure, I fail to understand why it should not, under normal conditions, continue to do the work asked of it, though capital outlay may have to be continued for some time longer. Personally, I am full of admiration for this spirited piece of engineering work in the heart of China, offering, as it daily does, a practical object-lesson to the Chinese of what they can do and have in their own country, provided they will exercise a little self-control, self-denial, and common sense.

The mistake made is in not starting "right there" (as our American cousins would say), with a few miles of line from the sea, or the head of navigation of some important waterway, to complete a line of communication. The most important bulky articles which Chinese railways have to carry are coal, timber, salt, beans, rice, and cotton. They will not at first be able to compete against good water-carriage for these staples (at least, not with a proper system of taxing goods), but they can start where this ends, and eventually what will happen has been demonstrated on the Pei Ho, which has quite ceased to convey the traffic to and from Tientsin and Peking.

In 1878, or thereabouts, Mr. Kinder built a little bit of a line to carry coal from the mines at K'ai-p'ing to the head of water-communication with Tientsin, a distance of a few miles. That railway has been since extended in both directions, until one end is at Peking, and the other termini are close to Mukden and at Newchwang. Somebody—I don't know who—started similar little bits of line from Wusung to Shanghai and P'ing-hsiang to Li-ling. The first will soon have its other end in Nanking (it would have been there long ago had the pioneer line been made from Shanghai to Su-chou instead of from Wusung to Shanghai), while the P'ing-hsiang line has reached that great waterway the Hsiang-t'an, and no doubt it will soon go further from both ends. Now, of these three, the first pays 5 per cent. to the bondholders, and the balance pays the new army; the other two will also pay well. They are commercial lines—not political or strategical. The Pei-han line is an example of a "through" line; it will certainly pay its way one day, as will almost all sensibly constructed lines in China, but not for some years.

Commercial Geography.

This subject is beyond the scope of my present paper. I will only say that, although there is plenty of room for development, yet the people are poor; by which I do not mean starved, or lacking the absolute necessities of the simple life, but not possessing capital sufficient to purchase expensive articles, which at present they have not yet been educated up to the standard of feeling in want of. Something should be done to foster cattle, sheep, and horse-rearing in Outer Chih-li and the K'ou-wai; there is money in it. If the Chinese are going to

take to milk (tinned or fresh) as they have to kerosene oil, opium, and cigarettes, there should be millions in a Mongolian cattle-ranch.

There is a good deal of gold and silver in Outer Chih-li, besides coal, which will eventually prove workable, I think—I mean, of course, by Chinese, not foreign companies. Much of the gold is not worked, because, after paying royalties and local taxes to the Chinese interested, there is not enough left to divide among the foreign shareholders. As is well known, China is one vast coalfield; one can march for days literally on top of the coal. There is no doubt about the quantity, and, I believe, quality also—at any rate, of the coal deposits along the borders of Shan-hai and Chih-li, and in north Ho-nan and in Hu-nan and Ssŭ-ch'uan. Some day, of course, the Chinese will burn coal and make gas like other civilized countries, and then all those lucky people who own coal-mines will become millionaires. Possibly, too, they may discover kerosene oil—then where, I wonder, will the Standard Oil Company come in?

In China things move slowly but surely. Profits are small, but must be reckoned in millions. If an article can be sold in China at a profit of only one-tenth of a penny, it is just a question of the number of Chinese who will use it, whether it pays or not to import it. They want cheap things, not because they do not like dear things, or because they are unable to tell the difference between a good and a bad article (they quickly learn that), but because they simply do not possess the wherewithal to purchase the better article; nine-tenths of the people live simply from day to day. They are taking to cigarettes like other people, and in a decade or two (in China one speaks of a "decade" rather than of a "year") Chinese men and boys, and half the Chinese women and girls, will smoke anything from one dozen to one hundred cigarettes per diem. The interesting point to foreigners is, will these articles be home made?

In Northern China the people will, not improbably, also become beer and wine (grape) drinkers, and will likely manufacture these beverages themselves. Within the boundaries of their empire they have everything a great nation needs, except indiarubber and kerosene oil. They may yet discover how to produce locally these necessities also.

In Central China, on this last journey, I found everywhere in the interior a very rough and strongly made cotton-cleaning machine of the simplest construction, worked by the foot. It was a Japanese manufacture, and cheap, costing only £3 10*s.* to £4 10*s.* even in out-of-the-way mountain districts, removed from water-communication. There is room for similar rough and cheap semi-modern machinery of this nature, for agricultural and farm uses and for purposes of irrigation. The Chinese are not yet nearly ready for the wonderful machinery which we find listed in the catalogues sent to our consulates in China for distribution in the interior. Be it noted, these catalogues are more often than not in the English language. On the cotton-cleaning machines were nothing but Chinese characters.

Chinese Character.

To the end that we may obtain a materialized conception of the Chinese unsearchable mind, some people tell us that we should first stand on our heads and then think backwards. But it seems to me the best way to try and understand it is to realize that the Chinese are (that is, the great bulk of them) still where Confucius left them more than 2000 years ago. What, I ask, was the condition of Europe then, or even of England only 500 years ago? Now, my experience of the Chinese

SOME SPECIMENS OF HUI-CHOU SCULPTURE, PARTLY DESTROYED BY T'AI-P'INGS.

man in small things has been that once he decides to undertake a business he goes through with it to the end: not, maybe, exactly as we would, nor as we should like, nor perhaps in the best possible way, but in the long run he gets there somehow. Let me give an illustration which relates to geography. I was about to undertake a journey of many months' duration, and I wanted to make a plane-table traverse of my route. I wished to find some educated Chinese who could do this plane-tabling

for me, so that I might be free to attend to other matters. This was some years ago; and where now you might find a hundred such men, then they were *raræ aves*, especially at the somewhat low rate of wage I was able to afford. Eventually, however, through the kindness of an American gentleman, I secured a really delightful young fellow, full of life and energy, but to my great grief he knew nothing of plane-tabling. When I pointed this out to him, and said I thought he might not do on that account, he said, "Oh, I can learn." And learn he did, so quickly and well that within a fortnight he was able to commence the route-traverse on a scale of 2 miles to 1 inch, and (although it seems incredible) that fragile, delicate-looking Chinese gentleman continued plane-tabling for over 2000 miles, up and down mountain and valley, over most difficult country, often unhealthy and feverish, through every degree of temperature and all conditions of weather, yet he never omitted a village or hill which he could see, nor a stream which he crossed, nor laid aside his plane-table for a single day, except one day when it snowed too heavily for work. So much for a reformed Chinese Christian, for even as he never ceased his work, neither did he ever omit each night, no matter how wearied or how late the hour, to read his Bible and say his prayers.

One more example. Several instances of the value of Christian ideas, when they have properly taken root in the Chinese character, have been cited in connection with the "Boxer" uprising in 1900. I will only refer to one man, but to him in no small measure is due, so far as the British are concerned, the happy ending of the siege of Peking by the early entry of the British troops through the Water-gate, for he was, among our guides, almost the only reliable one we had. Owing to my previous knowledge of North China, I had been selected to assist in the advance to Peking, and it was my daily duty to obtain information concerning affairs in the front and regarding the routes to be followed, etc. My guide, comforter, and friend throughout that trying fortnight was a Chinese Christian, one of the first to try to take a message to Peking, but who, failing to obtain entrance to the Legation, had returned, twice running the gauntlet of the Boxers. Nothing daunted, he would have again essayed the dangerous task, but I kept him to act as my orderly. I had no servant, so he did everything for me. I had two ponies, a bay and a grey, which we rode each day alternately, but he often volunteered to ride the grey all the time. He never tired, and never left me, and risked his life often. To my great regret, he died in 1903 at his home. "A little leaven leaveneth the whole," and Sir Robert Hart may be not far from the truth in the horoscope he has cast for the Chinese; only I do not think they will be Boxers.

Who, after such examples, will prophesy what the reformed Chinese shall not accomplish? Ten years ago such men were not common, now there are hundreds—nay, perhaps thousands like them. I hold no brief

for the Chinese. I take them as I have found them, good, bad, and indifferent, much the same as the people of any other country, but I will say this—that in some great essential virtues they certainly excel. It is these very virtues which Western civilization may, in its frantic efforts to force upon them all its good things and some of its vices, destroy. These old-world charms of character, to call them nothing else, may be stifled. They are—reverence for parents and age, sobriety of conduct and demeanour, temperance; cheerfulness under adverse conditions, bravery in the face of death; and, lastly, business integrity. I might even add, in this strenuous time, a complete absence of "nerves," and the power to sleep in any position or under any circumstances. There are, of course, numbers of people who know the Chinese far better than I do, and they will perhaps not altogether agree with me in my estimate of their virtues, especially where it concerns bravery. Well, the Chinese are in this respect a contradiction in terms. During the last hundred years or so, the soldiers have taken to running away when faced by the soldiers of a resolute enemy, but I do not think it was fear of being killed which made them fly. It was, first of all, a desire to live; because, not having been taught otherwise, they could not see any particular use, or advantage that would accrue to themselves, or any one else by getting killed. Next, it was a belief that, if killed, or wounded and left on the field, they would be mutilated, and arrive among their ancestors in this condition. This belief may seem absurd in this twentieth century, but it is so real to the Chinese, that they will pay large sums of money to ensure going out of this world in a whole condition of body.

China's Twentieth-century Army.

This brings me to the question of the value of China's new army as a fighting machine—potential, not present value. No army in modern times will fight except for a cause which appears to the bulk of its soldiers a just one; one in the interests of their own hearth and home. The more intelligent and civilized an army is the more is this the case. If this be true of other nations it is doubly true of the Chinese, for to them "home" means all, everything worth living or dying for. It is represented by the character "chia," which is composed of the character for "pig" placed underneath that for "roof." This may seem to us a poor conception of home, but was ours any better, I wonder, two thousand years ago? Chinese ideas of home are the same now as then. They change their ideas slowly. Consequently, before one can expect a Chinese army to stand and fight to the death, each soldier (or at least a majority) must see clearly that it is his interest to do so—that he is fighting for the existence of his hearth and home, and, through it, for national existence. At present they are far from comprehending this. At learning drill, manœuvres, military

exercises, and all about modern warfare they are adepts. Under favourable conditions, they quickly acquire the proficiency and accuracy of the German Imperial Guard on the parade ground; while at examinations for fitness for command, or at military sketching, reconnaissance, etc., they soon learn to excel. What they lack individually is the will to fight for what, hitherto, has been to them an incomprehensible object. As an army their fighting value is still inconsiderable, because of divided interests, and the corrupt and inefficient way in which an excellent system is worked. But it will be several decades before the Chinese are able to grasp the full meaning of the Japanese soldier's maxim—"Watakushi wo sareti oyake ni hozuru,"—the casting away of self to save the commonwealth.

Conclusion.

I have now completed a rough and wholly inadequate sketch of some recent British explorations in Northern China and the Eastern Part of the Central China Region. Though only a tithe of what has been accomplished has been mentioned, it is, I hope, sufficient to show we have not been idle. The results of the survey work are being used in the compilation of the one-to-a-million map of the Chinese Empire, on which Major Close has been for some time engaged, and several provisional sheets of which I have been enabled, through his and Captain Fraser's kindness, to exhibit.

Among those travellers who have recently contributed to our geographical information concerning Northern China are not a few Fellows of the Royal Geographical Society—Campbell, Bruce, Young, Kidston, Russell, Hedley, Pereira, Woods, Maguire, Webster, Doveton, McCleverty, Turner, Gunter; while there are others, such as Goold-Adams, Mahon, Williams, and Leake, who, I regret to say, are not Fellows.

All, or nearly all, these explorers have been assisted by Indian surveyors. Our thanks are due to these silent workers, who have done so much to fill in the blanks on our maps of the Chinese Empire, and several of whom have lost their lives in the work.

Another who, though he may not have taken latitudes and longitudes, or determined the exact heights of hills, has contributed, as a Fellow of this Society, towards the sum-total of Chinese geography, is the *Times* Peking correspondent, Dr. G. E. Morrison, to whom not a few travellers are indebted for assistance and for the use of his unique library relating to Eastern Asia.

My remarks concerning our topographical work in Inner and Outer Chih-li would not be complete were I to omit to record the harmony which ruled among topographical sections and travellers of the many nationalities in North China, and the truly international spirit which influenced those engaged in the work, by which mutual exchanges took place, adding to the general knowledge and facilitating the work.

But perhaps the brightest side of this geographical work in China is that we received valuable assistance from the Chinese themselves, both officials and people, who seemed quite able to understand that topography and geography did not necessarily mean gunboats and howitzers!

May I here interpolate a word on behalf of the much-maligned Chinese Government? So far as I have been able to observe, whenever it has been approached by travellers *bonâ fide* in search of information of a scientific character, it has invariably rendered a free and generous assistance.

What I have experienced in this connection leads me to believe that

EN ROUTE FROM TZU-LI HSIEN (IN HU-NAN) TO WAN HSIEN (IN SSŪ-CH'UAN).

the time seems opportune for the institution of a Chinese Government Survey Department, which would do for China what hitherto other nations have tried—somewhat inadequately, perhaps—to do for her. There are now quite a number of capable Chinese surveyors; quite sufficient to make a start with.

Then, with a Chinese Imperial Geographical Society, we should be released from the great burden of trying to map the third biggest empire in the world, instead of letting its 400 million people do it for both themselves and us. The Japanese have, I believe, a Geographical Society, and it does seem a pity that such a literary people as the Chinese should be without one. I think they should be approached on this subject.

To those who have fears that the Chinese cannot take care of themselves, I would recommend the perusal of the latest work on the subject, entitled 'The New China,' by an American author, Mr. Millard. I have selected the following quotation from his work with which to conclude this paper. He writes, "It is difficult to conceive how Japan, with scanty natural resources, will be able to industrially and commercially overtop a country like China, upon which nature has lavished her favors, and where an intelligent, capable, and industrious people are ever ready to apply their activities. What reason is there to warrant the opinion that, in a prolonged industrial and commercial struggle, China—with a land of unsurpassed fertility and vast extent, with undeveloped mineral resources of incalculable variety and value, with willing and efficient labour in any quantity, and with immense capital of her own—will be distanced by a competitor like Japan?"

Before the paper, the PRESIDENT: I note the presence here of a good many visitors and Fellows of the Society whom I am sure we shall wish to join in the discussion, so that I do not propose to occupy your time with introductory remarks, especially as Colonel Wingate's eight or nine years' work in China is well known by the general public. The only thing I shall say is to remind you that some years ago he contributed a very valuable paper to our *Journal* on his noteworthy journeys of 1898–1899 through China to Burma, which paper I think some of you will like to read after you have heard his paper to-night, and I will therefore remind you that it is in vol. 14 of our *Journal*. I will now call upon Colonel Wingate to read his paper.

After the paper, the PRESIDENT: I received a letter this morning from Lord Curzon, who is in the country, expressing his regret that he is unable to attend here to-night to hear Colonel Wingate's address, otherwise I should have called upon him first to open the discussion. But we have here to-night the late very well-known Minister of China, who is now ambassador in Japan, Sir Claude Macdonald, who must, I am sure, have felt strange emotions in looking at some of the photographs that Colonel Wingate presented to us. I believe Sir Claude is one of the few persons who has ever read his own obituary or possessed a ticket to attend his own funeral. I recall the last time I saw him on this platform, when he gave us an interesting address, about fifteen years ago, on the Explorations on the upper Benue.

Sir CLAUDE MACDONALD: At the request of Sir George Goldie, it gives me great pleasure to say a few words. Judging from a five years' experience of China, I can entirely endorse everything Colonel Wingate has said so far as the Chinese are concerned. I have always found the peasantry intelligent, thrifty, hard working, and friendly. With regard to the commercial classes, their reputation for probity stands very high; there is a phase of this commercial morality, however, which is interesting, which is common to most classes, and which, with your permission, I will illustrate by a short story told me by my friend Sir Robert Hart. He said that in his earlier days in the Imperial Maritime Customs he was promoted from the post he then held to a somewhat higher one, and his salary was raised in consequence. His head "boy" was a most excellent and honest individual, who took a fatherly care and interest in his young master. Sir Robert noticed, however, that when his salary was increased, his weekly bills also rose. On expostulating with his boy, he was met with the surprised answer, "Master get chancee, boy must get chancee too."

Some of the pictures shown upon the screen to-night have brought to my mind reminiscences of the siege of the Legations in 1900, and notably the picture of the water-gate, through which the British troops entered the Legation quarter and effected our release. A detail of that entry through the water-gate will, I think, interest you. Colonel Wingate has said that it was through my foresight that the troops were able to get through that gate; this is not altogether correct, because my assistant on that and many other occasions was a great friend of mine, an American cavalry officer, Squiers by name, who subsequently became the first American Governor of Cuba. He came to me when the relieving forces were close at hand, and produced a map of Peking, not unlike the one which has been shown upon the screen, and pointed out that if the troops could come over the wall of the Chinese city and advance through this city, they would be able to enter the water-gate into the Legation quarter. Two copies were made of this map, and sent, with directions, in the sole of a Chinaman's boot, to the American and English generals respectively; the directions stated that the position of the water-gate would be marked by three flags, the centre one, a Union Jack, being hoisted on the Tartar city wall immediately above the gate. Early in the morning of the day we were relieved (August 14), I received a message from the chief of the staff to say that the centre flagstaff had been shot away, and the flag was hanging over the wrong side of the wall; he added that if I would send somebody to mend the staff, he would get it rehoisted. I at once despatched a bluejacket carpenter, who with his pal, a signalman—the latter with his two signal hand-flags—very quickly mended the flagstaff, and also stopped on the top of the wall to see the fun. Following instructions, our troops worked their way through the houses and narrow streets of the Chinese city, meeting with but little opposition. When they came to the end of the houses, they found an open space about a hundred yards across, separating them from the Tartar city wall, on which they saw the three flags, which, however, were hanging in straight folds. There was a death-like stillness, and our troops hesitated because they thought there was treachery, and that this was only a plot to lure them into the Tartar city. Suddenly, close to the centre flagstaff, they saw a small flag violently "wagging," and spelling in the Morse alphabet "Come in here"! This was my friend the signalman, who had seen their hesitation and had waved this message. With a cheer, our troops charged across, dashed through the water-gate, and were first into the Legation quarter. Well, I am sure it will interest you all to hear that directing this little party and acting as its pilot was our lecturer of to-night, Colonel Wingate. In conclusion, a word about Japan. As your President has told you, I have the honour to represent His Majesty at the court of the Emperor of Japan, and I would take this opportunity of saying how much I love the country and its sympathetic and chivalrous people. Our alliance with Japan has been criticized by some. You will have doubtless seen what the President of the United States in his recent message to Congress has said about our allies; if what he says is correct—and personally I endorse all of it—I venture to think, to use an English expression, that we have put our money on the right horse.

After some preliminary remarks, Lieut.-General Sir EDWIN COLLEN said that he wished to lay emphasis on the fact that we, as a nation, were responsible, with Japan, for the peace of Asia, for the independence and integrity of the Chinese Empire, and for the principle of the "open door." We knew what Japan was doing, but what were we doing, on our part, to take up the burden of our responsibilities? He was well aware that the Society was doing a great work in focussing the information obtained by explorers, but we wanted more knowledge, and to bring it home to larger numbers. He entirely agreed with the lecturer that efforts should be made for the establishment of a Chinese Imperial Survey Department. He

submitted that we needed, first, the production of good maps accessible to all, although he was aware of what had been done in this direction, as shown to them that evening; secondly, the gathering up of geographical and other information in a complete work or series of works on the geography of China. He referred to the good work of the Indian military surveyors mentioned by the lecturer, to the original conception of the "Guides" in India, and to later developments of Sir Henry Lawrence's idea. He submitted that we should maintain a strong intelligence department in China, and not allow officers like Colonel Wingate to drift away altogether into ordinary regimental life. Several years ago he had presided at a lecture given by Colonel Wingate at Simla, and had then said that his exploration and labours entitled him to a high place on the roll of honour for work in the Far East. He now ventured to think that the lecturer had doubly earned that distinction.

Sir WALTER HILLIER: I had no idea, when I accepted the invitation of the President of the Society to attend this evening's lecture, that I should be called upon to speak, and the summons to do so has taken me completely by surprise. I am, therefore, utterly unprepared with any remarks. There are so many things the lecturer spoke about in his paper which interest one, that it is very hard to pick out a single subject for criticism or remark; but one statement he made especially struck me, and it was the only one I will venture to question. It was that the Chinese remain very much in the condition they were in the days of Confucius. Well, I must humbly beg to differ from him in this respect. He has come recently from China, and knows a great deal more about it and its present conditions than I do; but I happened to return there last year for a few months after a long residence in the country, and I think nothing struck me more than the wonderful progress the Chinese had made in every direction. I venture to think, before many years are over, we shall find, under the rule of the enlightened viceroy of Chihli, that China will take her place—I won't say on the same level as Japan—but that her progress will be such as to surprise the world. I quite agree with what Colonel Wingate has said as to China being able in the long run to hold her own. We hear a great deal about the Japanese commercial invasion of China, but I am quite certain that the Chinese are astute enough to carry on their business in their own way, and to learn what they want from Japan, but not to take more from her than they require. I will not detain you longer with remarks on any other subject except to express the opinion, with which I am sure everybody will agree, that we have listened to Colonel Wingate's paper with deep interest. I happen to know something about Colonel Wingate's labours, because I was with him at the time of the "Boxer" rising at Peking, and I know what he has refrained from mentioning, viz. the immense amount of work he did, the hardships he has undergone, and the great pluck he has shown in visiting almost unknown parts of China.

Mr. BYRON BRENAN: The discussion which follows the paper, I think, is always more interesting if the subsequent speakers can differ a good deal from the lecturer, so with that object in view I listened most carefully in the hope I should be able to pick some holes, but I am sorry to say there are very few points upon which I can lay my reproachful finger, but I will try to do my best. The lecturer, whilst deprecating the views some might hold that it is rather a waste of money to perform services for the Chinese which they are capable of performing themselves, seemed at the same time to hint that it would be rather a graceful act on the part of the Chinese if they would more fully appreciate what we are doing for them. I quite agree that it is not a waste of money, but it would be a waste of time to try to persuade the Chinese that our object is entirely altruistic. Some years ago Japan did some very good survey work in Manchuria in a very unobtrusive manner, so much so that she

had accomplished her work before anybody knew she was at work at all. When the China-Japanese war broke out, she knew more about the country between Corea and Peking than did the Chinese themselves. In the same way some people have taken a great deal of trouble and spent much money in making surveys of possible railway routes and prospecting for minerals, but it would be very difficult to persuade the Chinese that they are animated by motives of pure philanthropy. It would be out of place, in such a Society as this, to enter into the reasons why China would be ill advised to give railway concessions to foreign capitalists. A foreign-owned railway in any country, managed and controlled by aliens who with their railways are above the law of the land, is an anomaly too flagrant to need comment. I don't quite agree with the lecturer when he says China is too poor to construct her own railways. The money is there, but it is not forthcoming, and it will not be forthcoming until the Chinese people have some confidence that the money will be honestly spent, and the earnings of the railway will go into the pockets of those who provide the wherewithal. The obstacles which railway development in China have to overcome are not so much the rivers and the mountain ranges, about which we have heard to-night, but the hesitation, the fear of the Chinese people that they will not receive fair play at the hands of their Government. The fact that a contract entered into with a foreigner is considered by the Chinese Government to be more binding than a contract entered into with their own people is the reason why it is now necessary to go abroad for money, and that is a reproach on the Chinese Government which it rests with them to remove. The lecturer referred to the good feeling he found everywhere amongst the people, and the good reception he met with. It has been my pleasure to know Colonel Wingate in China, and see him at work, and I am sure if every explorer possessed the same tact and the same patience and the same kindly feeling towards the natives, we should never hear of any regrettable incidents.

Major Close: I have only one remark to make. Sir Edwin Collen mentioned, as one of the things very desirable, the provision of maps of China. I have only to say that any one who wishes to get a map of a province of China has only to go to Mr. Stanford and pay half a crown for the latest War Office map that is published. They are not all published, but he will get the latest that are.

Major C. D. Bruce: I am afraid I am unable to offer to you to-night any either commercial or political information such as has been given by those gentlemen who have spoken since the lecturer finished. My own interest in Colonel Wingate's lecture is entirely with the work that he himself has done in North China in the last eight or nine years, that is to say, the map, and, if I may use the word, the intelligence work. Ten years ago, as he himself said, nothing practically was known—I speak under correction of the War Office—nothing practically was known of the area of which he has unfolded the history to-night. What has been done since that work began is due almost entirely to Colonel Wingate, whom I myself have known and worked with during the last eight years. The work he has done will not be appreciated yet; it may never be appreciated in this country, because, I am afraid, people in England do not yet take China seriously. When I say seriously, I mean we have not yet arrived at that pitch of sympathy which my long acquaintance with China teaches me we ought to have. We know the French, the Germans, but we do not know the Chinese at all, yet we have been connected with them through India many hundreds of years. Well, when we get hold of the idea that China is a country like our own, that the Chinese are human beings like ourselves, then, I think, we shall be on the high-road to understand them. At present one person who comes from China gives you one idea, another gives you another. My own idea is, if I may offer it, that if we

take them as human beings like ourselves, we shall soon be at the root of their difficulties, and sympathize with them. Colonel Wingate in his lecture referred to the Indian surveyors with whom and under whom, under his direction, most of his work was done. I can add very little to what he has said about the value of their work. In my own case, I had one with me who worked for many months under great difficulties, who went on day after day in high altitudes, night and day, badly fed, badly clothed, under conditions which, I am sure, no European could have stood, and I can only say that if my attitude to him had been all through what his was to me, I should feel more proud of myself to-night than I do. From the day we started to the day we got in he never had a cross look on his face, which is more than most Europeans can say. He belongs to one of the most valuable services which we as a nation possess—that is, the Survey Department of India. Colonel Wingate made some remarks about the Chinese surveyors he had with him. In one or two cases they were Christians. Perhaps it is a subject hardly fit to be entered upon to-night, but it is another point with regard to the Chinese that we can all try and get into our minds, that is, the Chinese Christian, when he does become a Christian, is frequently a very valuable man. In 1900, apart from the military trouble, which all began over the missionaries—though whether the missionaries were to blame or not, it is not for me to say—any one who knows what went on knows that the confidence of the missionaries in their Chinese converts was amply fulfilled. Such acts were done which probably in this country are hardly known of, by these Chinese Christians saving missionaries' lives, keeping them hidden for weeks and months, and all simply because they learnt what we had taught them. I have rather wandered from the point of the survey work, but I must now get back to it. I will say, in conclusion, that, although perhaps it is a controversial subject, if the War Office can find in the next ten years as many officers who know and understand the Chinese as well as Colonel Wingate does, and if they can send them out to China, the country will benefit very much by their presence there.

The PRESIDENT: I need not ask you to give a hearty vote of thanks to Colonel Wingate, for it has been quite evident that his address has not only been extremely valuable, but has also been extremely interesting to us all. I do not remember any evening that I have been here on which I have heard a more interesting lecture.

Colonel WINGATE: Were I to attempt to take up all the points on which the speakers have touched, and which have been most interesting, I should have to ask the President to suspend the 10-o'clock rule. For, as you know, the Chinese and China are like the river, they go on for ever. One might speak, not only for a few minutes, but for two or three weeks, or a month, and not exhaust the subject. Consequently, I am sure, you will forgive me if I do no more than thank you all for the very patient way in which you have listened to the few remarks I had to make; also, I should like to thank those speakers who have said such pleasant things of me, and which, I am sure, I do not deserve.

THE MOST RELIABLE VALUES OF THE HEIGHTS OF THE CENTRAL AFRICAN LAKES AND MOUNTAINS.*

By Captain T. T. BEHRENS, R.E.

Now that the surfaces of the three principal African lakes have been connected with each other and with the Indian ocean by a complete series of trigonometrical operations, it is time to compare the heights so obtained with those hitherto determined by barometer and hypsometer readings. In addition to the lakes, the principal peaks of the equatorial region of the African continent have been trigonometrically connected with varying degrees of accuracy: and it will be of interest to collect the various observations in one list, giving the heights with their probable errors. The heights we are now able to assign to the great summits will, at any rate, be consistent amongst themselves, and more reliable than previous determinations based only on barometric or boiling-point data.

The best determination for Lake Victoria at present is undoubtedly that obtained by the Uganda railway levels brought up from Mombasa. An error of 0·25 inch per half mile was permitted by the engineers, but if the two lines run between any two successive bench-marks exceeded this, the levelling was done over again. The bench-marks were placed at half-mile intervals. If the true probable error of the result varied as the square root of the length of the line of levels, that is to say, if all constant errors had been eliminated, the error of the result would be less than $\pm 0{\cdot}75$ foot.

Previous experience would not justify us, however, in assuming so small a probable error. When we consider that no accurate determination of mean sea-level has been made, that it still remains to check the original level books to ascertain that the most probable result has been obtained from the observations, and to ensure the elimination of all arithmetical errors before the result can be looked on as scientifically reliable, we shall not probably be wrong in assigning a probable error of ± 3 feet to this value.

The range of oscillations of the lake-level in eight years, from 1896–1904, was 3·75 feet, so that for giving a figure to the mean level of the surface of the lake, we have a more than sufficiently accurate result. The zero mark on the lake gauge at Port Florence is 3720·15 feet† above mean sea-level at Mombasa. The mean level of the lake between 1899 and 1904 may be taken as 3720·3 feet $\pm$ 3 feet above mean sea-level.

A continuous series of trigonometrical heights have now been carried

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* Research Department, December 14, 1906.

† The Uganda railway levels are referred to a datum approximating to mean low water spring tides, hence 6 feet had to be deducted from the railway figures.

from Lake Victoria (by the Anglo-German Boundary Commission) to the trigonometrical points of the German Government's survey of West Usambara. It is to be regretted that, although this survey is very accurate in itself, it is nevertheless based on a barometric datum. In 1905, however, the southernmost point of this net, Genda-Genda, was found to be 1710 feet above mean sea-level at Zanzibar. The observations were reciprocal and simultaneous, and so most probably accurate. Unfortunately, the Usambara survey has no height for this point, so the triangulation from Lake Victoria has not a first-class connection with mean sea-level. Another series of less reliable trigonometrical heights was carried up from the Indian ocean to Kilimanjaro by the

KILIMANJARO FROM THE NORTH-WEST (THE NYIRI PLAIN).
(*Captain Behrens, photo.*)

Boundary Commission of 1892, and was carried on from points of this survey to Kenya and other peaks by the Selater road expedition in British East Africa, 1895–97. The closing error of this work in a circuit of 600 miles was 25 feet.

The triangulation from Lake Victoria is, however, connected to the northernmost points of the 1892 survey, and gives us a connection of fair accuracy with the mean sea-level at Vanga. Using this line of trigonometrical heights, we find the level of the zero-mark on the Port Florence lake gauge is 3728·8 feet ± 18 feet above mean sea-level.

The largest portion of the probable error is due to the uncertainty of the heights between Vanga and Kilimanjaro. It is hoped that the German Government will shortly publish the height of Genda-Genda

KENYA FROM THE SOUTH-WEST.

(*H. J. Mackinder, photo.*)

referred to their Usambara datum. The height connection will then be trigonometrically homogeneous from Lake Victoria to Zanzibar.

The trigonometrical result, 3728·8 ± 18 feet, is very near the 3720·1 ± 3 feet of the railway levels. The weighted mean of these results gives 3720·4 for the zero mark. It would, under the present conditions, be impracticable to make so small a correction, and we may regard the trigonometrical value as showing that the railway value has been uninfluenced by any constant error of great magnitude.

On examining the fluctuation of the Victoria lake gauges, being careful to study the confused alterations of their zero-marks, we find that on January 7, 1903, the level of the lake was 3719·3 feet. On this date, from the west shore of the lake, a series of trigonometrical heights was commenced, which determined the heights of the peaks of Mount Mfumbiro, Kanyangungwe (the highest peak of Ruwenzori), and the surface of Lake Albert Edward in relation to Lake Victoria.

Accepting the lake-level on that date as 3719·3 feet above mean sea-level, we get the following results:—

	Feet.
Mount Ruwenzori, Kanyangungwe (the highest summit)	16,619 ± 7
Kanyangungwe, secondary peak	16,543
Mount Mfumbiro—	
Muhavura	13,562 ± 4
Karissimbi	14,683
Sabyino	11,881
Mikeno	14,385

	Feet.
The level of Lake ALBERT EDWARD on December 7, 1903	3,004
Height of station mark * on Mount HUNGA	7,172

An examination of the errors of this series of trigonometrical heights leads to the adoption of the following probable errors for the heights as above determined:—

Lake Albert Edward	p.e. = ± 7 feet.
Muhavura	p.e. = ± 8 ,,
Ruwenzori	p.e. = ± 10 ,,

These probable errors are based on the consideration of the errors of the operations themselves, and would only be true if all sources of constant error had been eliminated. It is, however, useful for purposes of comparison. A recapitulation of all the heights will be found at the end.

The peak Muhavura was a main point in the triangulation of the German-Congolese Boundary Commission, and the differences in height between it and the levels of Lakes Tanganyika and Kivu have been determined trigonometrically. It has been impossible to obtain accurate information about this triangulation and its relative accuracy. Trigonometrical heights were carried from Tanganyika at its northern end to

MERU FROM THE SOUTH.
(*Uhlig, photo.*)

the southern shores of Lake Kivu. The level of Tanganyika was taken as 780 metres (2559 feet) above the mean sea-level. This appears to

* This mark is 2 or 3 feet below the ground, and is marked by the base of a brass cartridge case cemented cap uppermost in a large stone.

ELGON.

(*Sir H. H. Johnston, photo.*)

be an arbitrary datum taken from some map. A barometric or boiling-point height for Kivu was determined, and the mean of the two results was adopted as the height of the Lake. The height of Muhavura was then found by adding the trigonometrical difference in height between its apex and the water-level at the north end of Kivu to the height so determined. The trigonometrical difference was 672 metres (2205 feet) and the barometric difference 678 metres (2224 feet) between Lakes Tanganyika and Kivu.

We have then (3334 metres) 10,938·4 feet as the trigonometrical difference between Muhavura's apex and Lake Tanganyika. In giving this difference a probable error of ±10 feet, a liberally large value has been taken.

Between Tanganyika and Nyasa two series of trigonometrical heights were run; the weighted mean of these results gives 979 feet ±13 feet as the difference between the lakes.

We have, then, the following trigonometrical determinations:—

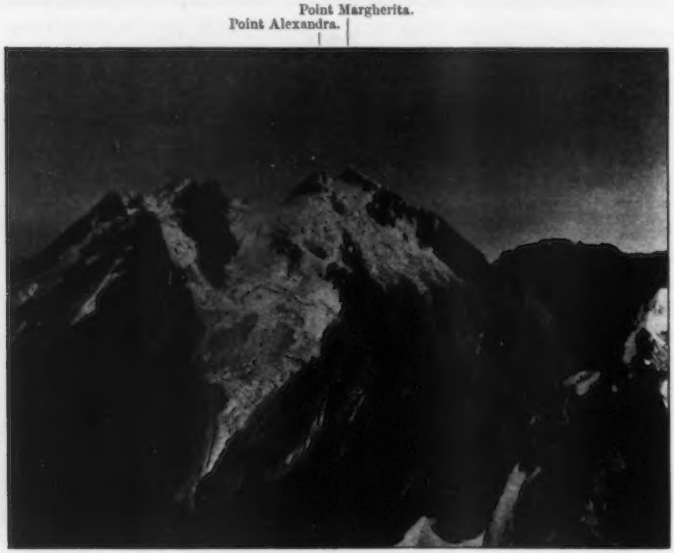
Muhavara	13,562 ± 7·9		
	− 10,938 ± 10·0		
Tanganyika	2624 ± 12·7		
	± 2·0	(p.e. of transferring height by means of the surface-level of Lake Tanganyika from north to south end.)	
	− 979 ± 13·0		
Nyasa	1645 ± 18·3		

We can now examine the results obtained for some of the same levels by barometer or hypsometer, collecting all the known determinations of each together. Much naturally depends on how the heights were worked out, even if we could be sure that the instruments were carefully tested and handled in addition to being accurately read. It is impossible to attempt to give a weighted mean as the result, for the original data are scarcely ever available. Travellers have mostly contented themselves with publishing bare figures, often without any hint as to the methods by which the results had been arrived at.

The summary is at the best rough and unscientific; its interest lies in showing the comparative accuracy of the African travellers' barometric and hypsometric results when compared with the results of observations of comparative but not geodetic accuracy, correctly computed and carefully checked.

The errors of a boiling-point determination are well known, but it will be useful to recapitulate them here. They are as follows:—

(1) Error of thermometer reading when checked against standard.



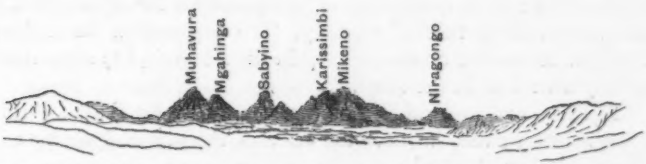
RUWENZORI: MOUNT STANLEY.

(*Signor Sella, photo.*)

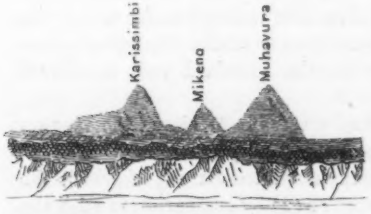
This error alters as the thermometer gets older, and makes it necessary to test thermometers both before and after an expedition. The alteration is due to gradual changes in the form of the glass of which the thermometers are made.

(2) Error in reading the scale.

(3) Error due to the correct boiling-point not being obtained round the bulb of the thermometer.

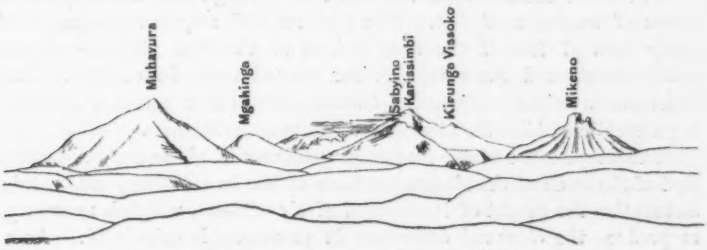


"DIE 'CENTRALSPALTE' MIT DEN MFÚMBIRO-VULKANEN VON GOHALI YA IVÍNSA AUS GESEHEN." ('MIT EMIN PASCHA INS HERZ VON AFRIKA,' STUHLMANN.)



VIEW OF UFUMBIRO MOUNTAINS FROM NEAR MTAGATA HOT SPRINGS ('THROUGH THE DARK CONTINENT,' STANLEY).

VIEW OF MOUNT MFUMBIRO, SEEN FROM RUMANIKA'S, KARAGWE ('JOURNAL OF DISCOVERY OF THE SOURCE OF THE NILE,' SPEKE).



MOUNT MFUMBIRO; OUTLINE AS SEEN FROM 1° S., 30° E.

(Captain Behrens, sketch.)

(4) Error due to alteration in boiling-point when the water contains salts in solution.

If all these errors have been reduced as far as possible or eliminated, it is easy to find the pressure of the atmosphere by looking out in a table the pressure at which pure water boils at such a temperature. These tables have been constructed from the results of direct observations. The pressure is given in terms of the height of a column of mercury at standard temperature at sea-level in lat. 45°. By this means we have then arrived at the pressure of the atmosphere at the observing station in terms of a standard measure.

Before arriving at the same result with a mercurial barometer, we have to contend with the sources of error enumerated below:—

(1) Error of the barometer when checked against a standard. This includes (*a*) errors of graduation, (*b*) compensation for expansion of the scale compared to that of mercury, (*c*) compensation for difference in level of the surface of the mercury in the reservoir, (*d*) correction for capillary attraction in the tubes.

(2) Error due to obtaining an incorrect value for the temperature of the mercury; this includes the error of the attached thermometer when checked on standard.

(3) Error due to the alteration in the force of gravity, (*a*) in different latitudes, (*b*) at different heights above sea-level.

When these errors have been taken into account as far as may be, we are in a position to compute the pressure of the atmosphere from the observed quantities in terms of the standard unit mentioned above.

The determination of the height of the point of observation is now made in one of two ways: (1) By comparing this pressure with pressures observed simultaneously at some station not too far off, of which the height above mean sea-level is known; or (2) by comparing it with the best value known or assumed for the mean pressure at the nearest point on the coast for that season of the year.

The latter method is at the best a very rough one, and may cause errors of hundreds of feet. The first method may involve errors of many tens of feet if the observations at the base station are not simultaneous, and the correction for diurnal wave be omitted. The difference in height between the two stations is then measured, assuming a certain state of the atmosphere between the stations.

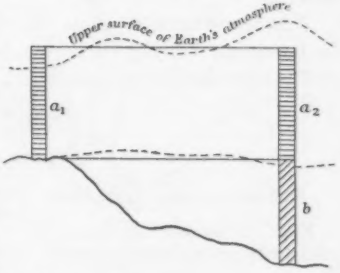
The temperature of the intervening column of air is supposed to be that of the mean of the air-temperatures at the two stations, and on this assumption the height of the column of air between, which is necessary to produce the observed difference in pressures, is calculated. As a refinement, a correction for the variation in the force of gravity, on a vertical and in latitude, is made.

Minute theoretical corrections are, however, of little use for practical purposes, as our assumption is not justified by facts, except within very wide limits. That is to say, the errors due to supposing such a state of atmosphere to exist between the two points entirely swamp all the other errors which we have not been able to eliminate by the correct reduction of the accurately observed quantities.

The factors of local climate and surface conformation, and the fact that it is not a problem of statics but of dynamics that we have to solve, fully account for the uncertainty of heights determined in this way.

A graphic representation of the problem is shown in the accompanying

figure. We have the weight of the columns of air a_1 and $(a_2 + b)$, and we assume that the weight of b is correctly represented by $(a_2 + b - a_1)$. Assuming an arbitrary state of the atmosphere in column b, we then determine its height.



The atmosphere is, however, not in a state of rest, and the upper surface would generally be represented by some irregular surface, as indicated by the dotted line in the figure. The surfaces of equal pressure are all in reality irregular, and the densities of the different parts of column b cannot be estimated with certainty.

At the same time we must not overlook this, that many errors, easily eliminated, have not been taken account of in travellers' published results; and as we have never had the *complete* data given us, from which the correct results of the observations might be recomputed, we cannot regard the travellers' results which are collected below as being uninfluenced by constant errors.

In this connection it will be interesting to quote a few words from a letter I received the other day from Dr. Kohlschütter. He kindly sent me in advance his computed results of the latest scientific barometer and hypsometer observations on the great lakes. After long and careful examination of the great quantity of material now available in the German East African colony, he has, I understand, introduced some alteration into the formulæ employed before, so as to bring the results more nearly into accord with the local effects of climate and the known difference in heights of the stations, where such were known. His results are given below, but not of course included in the general mean. A paper explaining his formulæ and results is already in the press, and will shortly be published.

Speaking of the residual discrepancies after applying all possible corrections, but using the original formulæ, Dr. Kohlschütter says, "It is a fact that the barometer heights in East Africa are very considerably affected by climatic factors. For instance, at Tabora in the course of a day the results of determinations at different hours have a range of 160 feet, and the monthly mean height even has an amplitude of 160 feet in the course of twelve months. The variations of the barometric height of Tabora, in consequence of the combination of these systematic and regularly recurring climatic changes, have an amplitude of about 325 feet. On the great lakes these factors have less effect, but even here the effect reaches about 200 feet. . . . . The differences between the different determinations after eliminating the climatic errors are small, and a single determination then has a mean error of ± 33 feet. This

error, the true mean error to be expected due to the accidental errors of observation, bears *no comparison* to the errors produced by climatic factors."

I have ventured to quote this *in extenso*, as the remarks have such an important bearing on the subject, and trust that Dr. Kohlschütter will pardon the liberty thus taken.

APPENDIX I.

BAROMETRIC AND HYPSOMETRIC HEIGHTS COLLECTED FROM ALL SOURCES.

NOTE.—It has been found impossible to separate the barometer, aneroid, and boiling-point determinations in the travellers' records.

Lake VICTORIA.

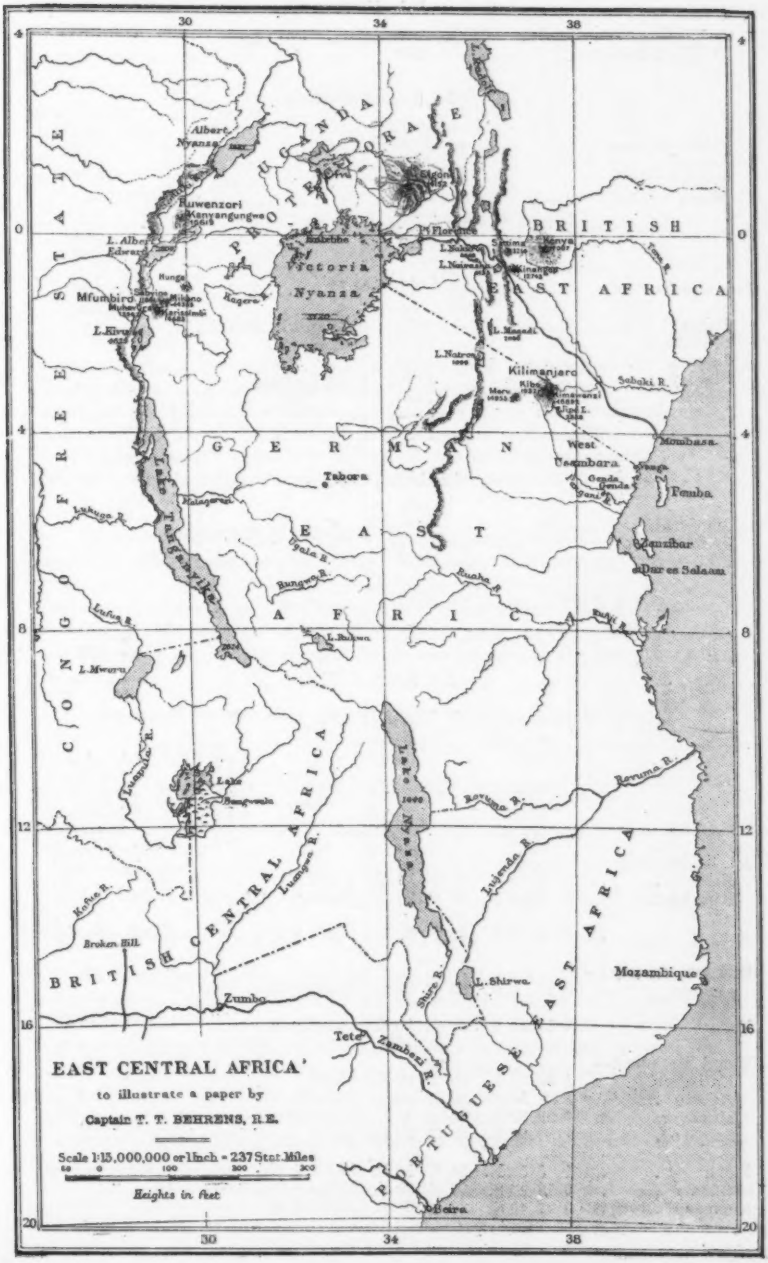
	Feet.	
Speke	3740	Range between different readings, 600 feet.
Stanley	4058	10 observations, calculated by Zöppritz.
Stuhlmann	3921	
Baumann	3904	
Pearson	4002	
Mackay	3500	
Thomson	3705	
Gedge	3900	
Macdonald	3820	
Scott-Elliot	3850	
Mean	3840	
Dr. Kohlschütter	3724	

Lake TANGANYIKA.

	Feet.	
Burton	1844	
Stanley	2790	18 observations, p.e. about ± 20 feet, calculated by Zöppritz.
Hore	2700	
Cameron	2709	
Stairs...	2690	
Wissmann	2670	
Popelin	2663	
Baumann	2897	
Reichard	2558	
Scott-Elliot	2712	
Mean	2623	
Dr. Kohlschütter	2566	

Lake NYASA.

	Feet.	
Kirk	1522	
Stewart	1629	
Anglo-German Boundary Commission—English party	1682	
Do. do. German party	1565	
Mean	1599	
Dr. Kohlschütter	1565	One year's barometer readings.


EAST CENTRAL AFRICA
to illustrate a paper by
Captain T. T. BEHRENS, R.E.
Scale 1:13,000,000 or 1 inch = 237 Stat. Miles
Heights in feet
BRITISH EAST AFRICA
GERMAN EAST AFRICA
PORTUGUESE EAST AFRICA
BRITISH CENTRAL AFRICA
CONGO FREE STATE
Victoria Nyanza
Albert Nyanza
Lake Tanganyika
Lake Nyassa
Kilimanjaro
Mombasa
Zanzibar
Dar es Salaam
Pemba
Tabora
Zumbo
Mozambique
Beira
Broken Hill
L. Shirwa
L. Mweru
L. Rukwa
L. Albert Edward
L. Kivu
L. Naivasha
L. Nakuru
L. Baringo
L. Rudolf
Mfumbiro
Ruwenzori
Kenya
Victoria Nile
Albert Nile
Semliki R.
Lukuga R.
Luapula R.
Lufira R.
Rungwa R.
Ruaha R.
Rovuma R.
Kafue R.
Luangwa R.
Zambesi R.
Shire R.
Tete
Quilimane
Sabaki R.
Tana R.
Juba R.
Uganda
Unyoro
Toro
Ankole
Ruanda
Urundi
Usambara
Usagara
Ugogo
Unyamwezi
Ufipa
Marungu
Lunda
Angoni
Nyassaland
Rhodesia
Kilimanjaro
Meru
Kibo
Mawenzi
Nyiro
Elgon
Elgeyo
Aberdare
Kenya
Longonot
Suswa
Donyo Sabuk
Mau
Sotik
Kisumu
Port Florence
Entebbe
Jinja
Hoima
Kagera
Mpwapwa
Kilossa
Morogoro
Kilwa
Lindi
Mikindani
Tunduru
Songea
Iringa
Ujiji
Kasenga
Abercorn
Fife
Blantyre
Zomba
Port Herald
Chinde
Tete
Sena
Zambesi R.
Shire R.
Luangwa R.
Lunsemfwa R.
Kafue R.
Zambesi R.
Luapula R.
Lufira R.
Lukuga R.
Rungwa R.
Ruaha R.
Rovuma R.
Lake Nyassa
Lake Tanganyika
L. Mweru
L. Rukwa
L. Albert Edward
L. Kivu
L. Naivasha
L. Nakuru
L. Baringo
L. Rudolf
L. Shirwa
Victoria Nyanza
Albert Nyanza
Mfumbiro
Ruwenzori
Kenya
Kilimanjaro
Mombasa
Zanzibar
Dar es Salaam
Pemba
Tabora
Zumbo
Mozambique
Beira
Broken Hill
Victoria Nile
Albert Nile
Semliki R.
Lukuga R.
Luapula R.
Lufira R.
Rungwa R.
Ruaha R.
Rovuma R.
Kafue R.
Luangwa R.
Zambesi R.
Shire R.
Tete
Quilimane
Sabaki R.
Tana R.
Juba R.
Uganda
Unyoro
Toro
Ankole
Ruanda
Urundi
Usambara
Usagara
Ugogo
Unyamwezi
Ufipa
Marungu
Lunda
Angoni
Nyassaland
Rhodesia
Kilimanjaro
Meru
Kibo
Mawenzi
Nyiro
Elgon
Elgeyo
Aberdare
Kenya
Longonot
Suswa
Donyo Sabuk
Mau
Sotik
Kisumu
Port Florence
Entebbe
Jinja
Hoima
Kagera
Mpwapwa
Kilossa
Morogoro
Kilwa
Lindi
Mikindani
Tunduru
Songea
Iringa
Ujiji
Kasenga
Abercorn
Fife
Blantyre
Zomba
Port Herald
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Tete
Sena
Zambesi R.
Shire R.
Luangwa R.
Lunsemfwa R.
Kafue R.
Zambesi R.
Luapula R.
Lufira R.
Lukuga R.
Rungwa R.
Ruaha R.
Rovuma R.
Lake Nyassa
Lake Tanganyika
L. Mweru
L. Rukwa
L. Albert Edward
L. Kivu
L. Naivasha
L. Nakuru
L. Baringo
L. Rudolf
L. Shirwa
Victoria Nyanza
Albert Nyanza
Mfumbiro
Ruwenzori
Kenya
Kilimanjaro
Mombasa
Zanzibar
Dar es Salaam
Pemba
Tabora
Zumbo
Mozambique
Beira
Broken Hill

Lake Kivu.

	Feet.
Dr. Kohlschütter	4790

Lake Albert Edward.

	Feet.
Stuhlmann	3166
Lugard	3240
Stanley	3307
Moore	3106
Mean	3205

Lake Albert.

	Feet.	
Baker	2070	computed by Dunkin.
Stuhlmann	2231	
Lugard	2150	
Stanley	2140	5 observations.
Moore	2100	
Mean	2138	

Lake Naivasha.

	Feet.	
Macdonald	6350	computed by Ravenstein.
Jackson	6302	
Scott-Elliot	6826	
Mean	6493	

APPENDIX II.

List of Trigonometrical Heights and Approximate Positions.

	Latitude.	Longitude.	Trigonometrical height.	Dr. Kohlschütter's barometric height.	Mean of travellers' barom. and hyps. heights.
	° ′ ″	° ′ ″	Feet.	Feet.	Feet.
Mt. Kilimanjaro—					
Kibo	3 4 30 S.	37 21 0 E.	19,321 ± 6	—	19,718
Kimawenzi ...	3 5 40 S.	37 27 20 E.	16,892 ± 4	—	17,569
Kenya	0 9 0 S.	37 18 30 E.	17,007 ± 30	—	17,200 (Mackinder)
Ruwenzori, Kanyangungwe	0 23 0 N.	29 52 20 E.	16,619 ± 10	—	—
Meru	3 14 30 S.	36 44 50 E.	14,955 ± 30	—	15,059 (Uhlig)
Mount Mfumbiro—					
Karissimbi ...	1 30 20 S.	29 27 20 E.	14,683	—	—
Mikeno	1 27 50 S.	29 25 20 E.	14,385	—	—
Muhavura ...	1 23 0 S.	29 40 30 E.	13,562 ± 8	—	—
Sabyino	1 22 20 S.	29 35 30 E.	11,881	—	—
Elgon	1 5 50 N.	34 34 10 E.	14,152 ± 30	—	14,094 (Jackson)
Sattima	0 18 40 S.	36 37 30 E.	13,214 ± 30	—	—
Kinangop	0 37 40 S.	36 42 20 E.	12,743 ± 30	—	—

	Latitude.	Longitude.	Trigonometrical height.	Dr. Kohlschutter's barometric height.	Mean of travellers' barom. and hyps. heights.
	° ′ ″	° ′ ″	Feet.	Feet.	Feet.
Lake Victoria ...	—	—	3,720 ± 3	3,724	3,840
„ Tanganyika ...	—	—	2,624 ± 13	2,566	2,623
„ Nyasa ...	—	—	1,645 ± 18	1,565	1,599
„ Albert	(deduced height difference)	with barometric	1937		2,138
„ Albert Edward	—	—	3,004 ± 7	—	3,205
„ Kivu	—	—	4,829 ± 10	4,790	—
„ Natron ...	—	—	1,996	—	2,132 (Fischer)
„ Magadi ...	—	—	2,050 ± 15	—	—
„ Jipé	—	—	2,333 ± 6	—	—
„ Naivasha ...	—	—	6,135 ± 30	—	6,493 (Macdonald)
„ Nakuru ...	—	—	5,668	—	5,980

NOTE.—The heights in the trigonometrical column are based on the mean sea level at Mombasa, carried to Lake Victoria by Uganda Railway levels. Lake Victoria is connected to Lakes Albert Edward and Tanganyika by a continuous triangulation. Lakes Tanganyika and Nyasa are connected by two independent triangulations.

Dr. Kohlschütter's heights were computed from recent observations made by reliable observers with the best instruments, and have been computed by his method.

Since this paper was read, the barometric determinations of all the snow-capped summits of RUWENZORI and their relative positions have been published by the Duke of the Abruzzi. The alterations to the positions of the minor peaks (to which there was only one theodolite ray) from those given in the July number of the *Journal* last year, has necessitated small changes in their computed heights.

The list of corrected trigonometrical values, compared to the barometric values, is as follows :—

Name of peak.	Trigonometric value.	Barometric value.	Difference, trigonometric minus barometric.
	Feet.	Feet.	
Margherita	16,619	16,814	−195
Alexandra	16,543	16,749	−206
King Edward	15,748	15,987	−239
Victor Emmanuel	15,846	16,079	−233
Umberto	15,554	15,797	−243
Yolanda	15,258	15,646	−388

The differences are very even; the discrepancy between the 195 and the 230-feet differences is due to the fact that the trigonometric height for the two topmost summits is the mean of observations from seven different stations, while the heights of the remaining four points depend on observations from one and the same station. The determinations for the topmost peaks from that station showed differences of 230 feet also. The Duke of the Abruzzi very kindly communicated to me his values quoted here, and remarked at the same time that the value he gave for Yolanda peak was less reliable, as it had been referred to an independent and less accurately determined barometric base station.

This perhaps accounts for a difference so divergent from the rest.

After the paper, the following discussion took place:—

Mr. Douglas Freshfield: I have some information from Uganda that may be fresh to the Fellows here. But, in the first place, I would say the remarks made by the reader of the paper are satisfactory to an amateur observer. It has always seemed to me that although we do not get scientific accuracy in our measurements of heights, we get approximate results which are useful for comparative purposes, and that often long before a Government Survey Triangulation finally settles everything. I hope we shall encourage travellers to go on using whatever instruments they have, and can manage. When the results are put together, they are often valuable.

With regard to Ruwenzori, I have just come across a record of the results of Dr. David's exploration on the western side. It appears in the *Journal* of the Italian Geographical Society, vol. 7, pt. 4. Dr. David states that Ruwenzori, or Runzora, is a local name, and that he heard it used constantly. He goes on to say that the range is known as Kokora on the Semliki side. He rather qualifies this statement afterwards by telling us that Kokora is the name of a district. It is consonant with what we find elsewhere, that the mountain should not be distinguished by a name separate from that of the region in which it rises. Dr. David gives as the height of the lower tongues of the glacier 13,100 feet, the snow-level as 14,600 feet, and he believes himself to have reached 16,600 feet. But as he also says he was 1400 feet below the summit, which is now shown to be not more than 16,800 feet, it is quite clear that this is an error. Dr. David describes the view he had from the point he reached. He was able not only to see Lake Albert Edward, but also the volcanoes further to the south. I can believe in that wonderfully long view, because after a storm, we saw from the shores of the lake quite clearly the Mfumbiro peaks. The people living in the plains say that when there is fine weather on the mountain, they have thick haze over the plains; consequently, when the Duke of the Abruzzi was on the mountain, he was never able to see the plains or Lake Albert Edward from any of the peaks he ascended. Dr. David confirms or rather anticipates what the duke says—that there are many separate little *massifs* or groups, each with several peaks. I have another recent letter, which only reached me yesterday, from Dr. Wollaston, who has been travelling for the British Museum in these quarters, dated, from Lake Albert Edward, October 18. He gives an interesting description of the doings of the Belgian party that is travelling in that region, and which, we are glad to learn, is to be joined shortly by an official British Survey Expedition.

Sir George Taubman Goldie: I did not intend to speak, but I wish to say a few words on Mr. Freshfield's closing remarks. I had a good deal to do with the system of marking boundary-lines in Africa, and, after a little experience, I steadily favoured the use of geodetic lines.

The system of using the frontiers of small states and tribes had led to endless complications and to a good deal of international trickery and friction; as whole districts which had always been regarded as subject to some central potentate were not only asserted to be independent, but were incited by colonizing powers to declare themselves independent. This more than once led us to the verge of a European war. The use of geodetic lines as frontiers had many minor disadvantages, but nothing comparable to those of the earlier system.

Major Hills: I do not know that I have anything very special to say about the paper, except to express my interest in it. I think perhaps the discussion, in entering upon the boundary question, has gone a little bit off the main point of the paper, so that I will not follow in that direction. But with regard to these level results, I should like to state my appreciation of the work that Captain Behrens has

done in bringing all this material together in an easily accessible form. I think it is most valuable, and just the sort of work which I understand this committee exists for. I have no particular criticism to offer on the actual figures. Of course, as we look at the results now, we see the first attempts of explorers were often very wide of the mark; and while we fully recognize, as Mr. Freshfield says, that even approximate results are better than none, we can only be glad now that they have been replaced by comparatively accurate and reliable data. An interesting question connected with the subject of this discussion is that of the possible change of levels in these African lakes. In the future, we may assume it will be a very important point to decide as to whether the lake-beds are sinking in level or rising, and it is therefore imperative to get true levels fixed as soon as possible.

Mr. FRESHFIELD: There are no signs of actual sinking on the shores of the lake.

Mr. GEORGE WILSON: I have listened with great interest to this discussion. May I be allowed to occupy just a few moments with reading notes which happen to be just by me at the moment? There seems to be a doubt as to the influence which mainly conduces to the rise and fall of levels on the Victoria Nyanza. The notes are by an officer in the Uganda Scientific Department, and are pertinent to this subject. They are: "The annual rise and fall of the lake, *due to rainfall*, is a matter of about 18 inches. The maximum height obtains during the months of April, May, and June, and the minimum during October and November. The maximum height during the current year was 18 inches above that of any previous year of which records are obtainable. The rainfall was also greater during the earlier part of this year."

In presenting these observations, I may perhaps add that during twelve years' experiences in the vicinity of the Victoria Nyanza I have always remarked that the rise in level has been coincident with rainfall, and the reduction with drought. The notes just read are based on records, and are confirmatory of this view.

Commander WHITEHOUSE: I have been asked to say something about the level of the Victoria Nyanza. My own work is fully adjusted to the railway level of 3726, all my soundings being referred to that datum. I conclude a great deal of care was taken when the level was taken across the lake to the westward. The level of the lake alters a good deal; the greatest range now registered on the Port Florence gauge is 5 feet 1 inch, and, as far as I can tell, it may be 6 feet 7 inches, which is a different state of affairs to that quoted in the paper up to the date given. I have pointed this out with reference to the dock at Port Florence. I have often been told that the level at Port Florence cannot be referred to water-marks outside the Kavirondo gulf in the more open part of the lake; but I do not see why, it being all one sheet of water. I have also pointed out to Sir William Garstin the range likely to be registered, for his information on the Nile waterway. From watermarks I found at Mohuru point on the east coast in 1902, and others found later at Mwanza on the south coast of the lake, it appears that the level may rise on the Port Florence gauge to +5 feet. This information was obtained by adding the height of these marks above water to the average reading of the Port Florence gauge at the same time. The action of the wind affects the lake-level everywhere, and more so at Port Florence. I have seen a difference of as much as 17 inches in one day there. A north-easterly squall drove the water 7 inches below the then usual level, and the south-west breeze in the afternoon raised it 10 inches above the usual mark. The same effect may be noticed in all non-tidal water. I have never found any currents on the lake, except those caused by winds. At Mbita, the narrow entrance to the Kavirondo gulf, I have watched sticks and cormorants floating east through it, and on a heavy squall coming up from the

south-east, I saw the current stop running while I was looking at it, and then begin to run through the channel to the west.

In Sir H. M. Stanley's photograph, taken in 1875, of the Ripon falls—a very low point, part of it about 2 feet high—is shown just above the biggest fall. The same point is shown in my photograph of the same spot in 1900. Apparently, therefore, there has been no permanent change in lake-level for over thirty years, which is the longest period that can be referred to.

I cannot say much about alteration of level due to change of barometric pressure, but I believe barometer-readings there do not vary very much. I set up a mercurial barometer once where storms occurred daily, and read it constantly, finding very little difference before, during, or after the storm, which was a very heavy one.

The level is probably slightly affected in this way, but there is not the slightest doubt that the principal daily change is caused by wind. When noting level, therefore, the general average should be taken, and not the reading of any particular day.

I have referred to morning readings only of Port Florence gauge; the level is nearly always higher in the afternoons, when the south-west wind blows up the Kavirondo gulf.

Mr. H. J. Mackinder: I am sorry I could not be here in time for the paper. I will therefore limit myself to one remark with regard to Kenya. The height given against my name in the table at the end is above the mean of my observations, and considerably above the lowest. I think the lowest was about 17,200 feet. If I remember rightly, also, the height obtained trigonometrically by Captain Smith was about 17,200 feet. I have not seen what are the reasons for somewhat lowering his number, or whether there has been some subsequent observation.

Mr. Freshfield: I should like to ask one question. At the north-eastern corner of Lake Albert Edward there is a channel which connects with a lake which lies under the eastern side of Ruwenzori. When we were there there was a river about 600 or 800 yards across, with a strong current flowing into Lake Albert Edward. Earlier travellers have written as if the water sometimes flowed the other way, from Albert Edward into the smaller lake. This apparent change of level may be accounted for by exceptional rains on the Ruwenzori range.

Sir Thomas Holdich: I have nothing to say except to point out that, so far as I know, from none of these mountain peaks have reciprocal observations been taken. Observations have been taken from the plains to the peaks, and not from the peaks to the plains; consequently, there can be no absolutely fixed determination of heights, and we must not be too certain, in talking of trigonometrical results, that the values of heights so fixed are at all the same as the values of heights fixed along a line of railway or on the lakes. Those we may well accept, as Captain Behrens has told us, with a small probable error of some 2 or 3 feet. But as regards Ruwenzori, I think it is quite possible that we may find eventually that we may have to alter these trigonometrical figures considerably. There are various reasons. In the first place, there is always a little difficulty in determining the exact point where the altitude terminates on a snow-covered peak, and also there may be a difference of level from time to time in the snow itself, but the great chance of error certainly rises from the fact of our having no determining value for refraction. To instance the highest mountain in the world, we know that it may eventually be proved that the height of Mount Everest may have to be corrected to the extent of about 100 feet or so, and we know that if we take the second and third highest, we may find that Kanchinjunga ranks second and K_2 third after possible corrections. Such determinations can only be finally made when the correction due to refraction is really finally determined. Consequently, I quite agree with what Mr. Douglas Freshfield said about geographical explorers sticking to their barometric observations, although

no one is more convinced than I am that barometric observations are generally untrustworthy. Still, they are better than nothing. At any rate, the figures which Mr. Mackinder and Mr. Freshfield have quoted are, I think, very comforting. They are probably not very far from the mean trigonometrical results. All I wish to point out is that we cannot always accept the heights given for great altitudes as quite on the same scientific basis as those of lower regions.

Major Hills: With reference to what Sir Thomas Holdich has said, I think it is quite clear that the probable error of a single triangular determination is smaller than that of the very best reciprocal barometer observations. In many cases the probability of getting reciprocal triangular observations is so very remote that it is not likely to occur for many years. By upholding barometric observations, you are deliberately taking a lower standard when you have a higher standard available.

Dr. H. R. Mill: I have nothing to say that can be of any importance on the question of the level of the lakes, beyond expressing the interest that I feel in the change of level produced by the wind. Changes produced by differences of barometric pressure may also be quite appreciable in such large sheets of water as the Central African lakes. They have been studied in detail with regard to the North American lakes, where I think the changes of level amount to something like a foot between one end of a great lake and the other when there is a great difference in the barometer. Wind, of course, banks up the water against one shore, and must necessarily reduce the level in other parts of the lake to a corresponding amount. With regard to barometric determinations of height, one can never impress too strongly the fact that heights so measured are only roughly approximate. There is a tendency on the part of some travellers to look upon determinations by the boiling-point as inherently better than determinations by a mercurial barometer; the worst of the uncertainty, however, applies equally to the hypsometer, which is simply a barometer of a different type. The great difficulty is that we do not yet know exactly how atmospheric pressure changes with altitude in different conditions of weather. In anticyclonic conditions the rate of change of pressure with height is probably somewhat different from that holding good during the passage of a depression. In fact, we know so little about the state of things in the upper strata of the air, that I should feel much happier if all barometric heights above levels of 2000 feet were only expressed to the nearest hundred feet. If this were done, the appearance of excessive accuracy in doubtful measurements would be avoided. The method of trigonometrical determination is essentially more accurate, and it is reasonable when that is employed to give the height to the nearest foot.

Mr. Lamplugh: As the change of lake-level has come under consideration, it may be worth saying a word from the geological standpoint. In a sheet of water of this size, there is always a possibility that there may be slight movements of the land in progress which may gradually tilt the bed of the lake, so that a rise or fall of the water-level at one end need not necessarily mean a corresponding change in every part of the lake. The Americans have found that their great lakes have been very slowly tilted in this way, so that the water-level has not remained permanent in relation to the land. In all discussions of the levels of large lakes, especially when, as in the present case, there appears to be a slight discrepancy in the evidence, this factor of the possible movement of the land should, at any rate, be kept in mind.

The Chairman (Major Close): Before asking Captain Behrens to reply to the remarks that have been made on his paper, I should like to say something about the hypsometer. I think it will be a great pity when it disappears—of course, it is bound to disappear. Absolute determinations of height are like absolute determinations of longitude—you never know the accuracy of your result. The determinations of Lake Nyasa vary between 1200 feet and 1900 feet. I quite agree that it is very

desirable these heights should not be put down as if they were accurate. I think they ought to be put down to the nearest hundred, as Dr. Mill suggested. A reference was made to the political side of the question, especially as regards the Congo-Uganda boundary. I think it is common property that a Boundary Commission has been appointed, and will shortly leave the country—a mixed commission—to survey that frontier. I will now ask Captain Behrens to reply.

Captain BEHRENS: The idea of this paper was to collect the hypsometer and barometer values together and see how they fitted in with heights determined by what is after all a reliable method, and more or less consistent. All the results have been carefully checked. Of course, the results do not pretend to geodetic accuracy; they are only good secondary determinations. It is a pity that the level of Lake Nyasa has not been determined somehow from the Indian ocean, or the Zambezi river. I endeavoured to find out if it had been, and the result was negative. I understand that the geodetic triangulation will soon be able to be connected up there, and then we may get a check on the result (1645) which the trigonometrical observations give. Of course, the probable errors quoted here—I cannot make this too plain—are not probable errors in a strictly scientific sense; it would have involved far too much labour and too much time to work out exact probable errors, but they may be regarded as approximately correct within a foot or two—that is to say, within a foot or two of what they would have been had they been very carefully worked out from the observations. I do not mean to say they represent the true probable error, taking all sources of constant error into account. Commander Whitehouse said something about whether we took the level accurately on the west of the lake.

Commander WHITEHOUSE: I did not hint you did not.

Captain BEHRENS: What I wanted to point out was this, that on that date we took the level of the lake on the west of the lake, as being that given by the reading of the lake gauge at Port Florence on the same day; it was so many inches above or below the zero mark, and we considered that the level from which we started. Of course, if the wind had been blowing, there was a small source of error there, but I allowed for that in my estimate of the probable errors.

Commander WHITEHOUSE: I understood you left the level on one side and took it up on the other. What I said was, you ought not to take the Port Florence gauge for that sort of thing.

Captain BEHRENS: You mean on account of the wind?

Commander WHITEHOUSE: Yes; if you take the monthly reading and strike a general average, you cannot depend upon accuracy. You cannot go on to decimals of feet.

Captain BEHRENS: That I am coming to. I allowed something in the probable error; I allowed a foot, taking the level across the lake in that way.

Commander WHITEHOUSE: I put a mark at Karungo; that is the place where the gauge ought to be. I asked them to look after it, and they went and dug it up as a bell. But for the lake-level there ought to be a gauge not at Port Florence—of course, the Port Florence gauge is good enough for my work—but it ought to be on the open lake, where it is not affected by wind.

Captain BEHRENS: The reason we did not take the readings of the Entebbe gauge is because there seems to be such confusion between the gauges, and we thought the best thing we could do was to stick to the Port Florence gauge. The daily range seems to be a very constant quantity. In looking all these things up in the table published by Captain Lyons, the daily differences between a.m. and p.m. readings seem to be fairly constant. It would be very interesting to see what the Duke of the Abruzzi makes for the height of Ruwenzori; I believe he has been

extremely careful. He has found a differential height, which he fixed by barometer readings between the top of the mountain and Port Portal, by constant readings for a month between it and Entebbe, so that ought to be fairly accurate. Mr. Mackinder spoke about the height I quoted for Kenya. The height quoted in the *Journal*, it seemed to me, was a little uncertain, and I should be very interested if we could discuss the matter further. It did not seem to me to be quite clear. I took what seemed to represent your barometric height as apart from anything to do with Captain Smith's.

Mr. MACKINDER: My measurements were four, and two were triangular from a base about 3000 feet up, which base was fixed hypsometrically. Therefore, those were really checks on the others, and they were all four ordinary hypsometrical measurements. So I thought it was perfectly justifiable to take an average of the four; two of them, the 13,000 feet, are barometric, and then the remainder trigonometric. I think that is more accurate than taking the top measurements.

Captain BEHRENS: I do not think I have merely taken the top measurements, but I have forgotten the details.

Mr. MACKINDER: My impression is you will find it average some hundred odd feet lower. But the chief thing I am interested in is how you get the difference of Captain Smith's measurements. He made his measurement 17,200 feet trigonometrically. There may be a difference in his base, but I think his base was the railway.

Captain BEHRENS: We compared the height we got with a large number of Captain Smith's previous measurements, and they seemed all to require a pretty constant correction, which was then applied. They seemed to be consistently higher or lower than our points, so I applied that correction to the height he found for Kenya.

Mr. MACKINDER: There was a general error, was there, with all his heights?

Captain BEHRENS: Yes. About that arm of Lake Albert Edward, I was in camp on the shore of it for about a month, and I do not think I ever noticed any current at all. I think it must be due to wind, much the same as it is in Lake Victoria; or it might have been due to Ruwenzori rains. I was there for a month in the dry weather, and there was certainly no current in it. I went up a long way in a canoe.

Mr. FRESHFIELD: The magistrate wrote to me and said there were the most exceptionally heavy rains he had ever seen, so that might have filled up the upper lake; but it is a huge sheet of water.

Captain BEHRENS: Yes, it is a big sheet of water further north, and only very narrow where it joins the lake.

Mr. FRESHFIELD: Yes; it is only a river for 10 or 12 miles.

Captain BEHRENS: About the coefficient of refraction. I did not mention it, although I think I mentioned it in some notes on the determination of the heights of Ruwenzori. The only check we had was when we measured the coefficient of refraction very carefully at the level of about 6000 feet. That was the best that could be done. I suppose it is a closer approximation than if we had taken a coefficient of refraction which corresponded with the value we used in the middle of the day for other points. The effect on the local attraction would also come in, but I do not expect this is nearly as much at the base of Ruwenzori as it is in the neighbourhood of the Himalayas. It would naturally affect the height of the summit.

So far as the observations themselves went, the range of the observations—there were seven—were very consistent within themselves, and the range was small. About giving the figures to decimal places of feet, it seems to me if you give any trigonometrical results it is desirable, if they are to be used to carry on further work, to preserve the last place. It does not mean to say accuracy to the last place

is claimed for the figures, but if any one is to carry the work on it is a pity they should lose even part of a foot, and if all the significant figures are given the work that is carried on from them must be by that small amount more accurate.

Sir THOMAS HOLDICH: I look on the determination of the height of Ruwenzori as important because it is the highest, and it will inevitably be the basis for the determination of many heights westward. It may be eventually carried on in another survey to the western coast.

Captain BEHRENS: The difficulty about using Ruwenzori as a sort of bench-mark is that one so very rarely sees it. I should be very sorry to have to go out there and take my initial height from the top of Ruwenzori. I was there for some months, and I never saw the mountain more than about eight times altogether, and that was only by jumping out of bed in my pyjamas and getting to the instrument as quickly as I could; by the time I had spent five minutes at the instrument it had usually disappeared. With reference to the possible movement of land and the tilting of the lake-bed, is it not a fact that if one had a large number of gauges on the lake this would be detected? I think that is all I have to say.

Mr. WILSON: May I just say I have a note in connection with the rise and fall of the lake which might be useful. It is very brief. The actual rise and fall of the lake due to the rainfall is a matter of about 18 inches. The maximum height obtains as a rule during the months of April, May, and June, which are the rainy months, and the minimum during October and November. The maximum height during the present year was 15 inches higher than in any previous year for which results are obtained. The rainfall also was greater, so that the maximum height has always been coincident with the maximum rainfall. I do not know if that is understood, but I happened to have the note. In 1894, which would be several years prior to the period, it was 18 inches below that, so that during twelve years the lake has varied 14·6.

The CHAIRMAN: I will ask you to pass a hearty vote of thanks to Captain Behrens for his very interesting paper, which I know must have given him a great deal of trouble to prepare, and I think it has conveyed some very interesting information.

THE CONQUEST OF RUWENZORI: A NOTE.

By DOUGLAS W. FRESHFIELD.

I VENTURE to submit, in the following brief note, the comments and reflections on H.R.H. the Duke of the Abruzzi's paper on "The Snows of the Nile," which I might have made at the meeting had there been any opportunity for a discussion.

I shall imitate the Duke of the Abruzzi in avoiding any lengthy argument as to the identification of Ruwenzori with Ptolemy's Mountains of the Moon. It is enough for me that its snows feed two of the Nile lakes. But I may point out the sort of rumours which two hundred years and more ago were recorded in Arab chronicles; for it is highly probable that stories of the same kind reached the Greek geographer, and were the ground of his long-disputed assertion that the lakes of the Nile are fed by eternal snows.

In A.D. 1686 an Arab compiler, quoted by Sir H. M. Stanley,* undertook to describe from earlier authorities the legendary snows at the Nile sources. I make here a few extracts from his compilation:—

* 'In Darkest Africa,' vol. 2, pp. 280–281.

"Others say that the Nile flows from snowy mountains, and they are the mountains called Kaf."

". . . This chain has peaks rising up into the air, and other peaks lower. Some have said that certain people have reached these mountains and ascended them, and looked over to the other side, where they saw a sea with troubled waters, dark as night. . . . Some say that people have ascended the mountain, and one of them began to laugh and clap his hands and threw himself down on the further side of the mountain. The others were afraid of being seized with the same fit, and so came back. It is said that those who saw it saw bright snows, like white silver, glistening with light. Whoever looked at them became attracted, and stuck to them until he died, and this science is called human magnetism" (*sic*).

"It is said that a certain king sent an expedition to discover the Nile sources, and it reached copper mountains, and when the sun rose the rays reflected were so strong that the men were burnt. Others say that these people arrived at bright mountains like crystal, and when the rays of the sun were reflected they burnt them."

Here we have a curious combination—references to snowburns, mountain sickness, and, one might almost add, to the *amor scandendi*. I may mention that the natives of Toro use and sell the fragments of crystal found in the range as charms, and that those who live far from the mountain still believe the shining summits they see from time to time among the clouds to be composed of the same substance.

It is, surely, rather a large claim on our credulity to insist that these graphic details were all pure inventions of the happiest kind and had no connection with the corresponding local facts.

I turn from legend to discovery. The Duke of the Abruzzi's map supplies us, for the first time, with a clear picture of the upper region. Its characteristic is the absence of any continuous snowy chain, and the number of relatively small glacier-clad blocks or *massifs* separated by gaps 2000 feet below them. In the upper region no extensive *névés* are found; the gneiss summits carry frozen caps, the substance of which heat and consequent infiltration rapidly turn into ice. A conspicuous and peculiar feature are the cornices supported by icicles which have grown into ice columns, till, looked at from below, they recall in form the cliffs of Staffa. There is little or no permanent snow apart from glaciers, but here and there an avalanche lies unmelted among the exuberant vegetation. As in most regions of similar geological structure (the Maritime Alps, the Adamello group) rock basins abound, and not a few have escaped from being choked by alluvial deposits, and contain still tarns, which reflect the snows and waterfalls of the highest peaks in a framework of giant Senecios and white Everlastings. Of these tarns the Bujuku lake appears to be the most fascinating.

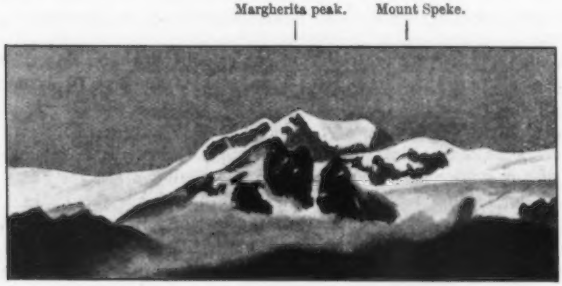
With his excellent Cormayeur guides and porters the Duke made a thorough sweep of the snows. Fourteen summits were scaled, and those that remain are of secondary importance. The finest expedition left is probably the glacier pass between the Alexandra and Moebius peaks, the western side of which may be studied in the excellent illustration opposite p. 288 in Dr. Stuhlmann's book, 'Mit Emin Pasha ins Herz von Afrika.' The illustration on p. 296 of the same work can, by the help of Signor Sella's photographs, be recognized as King Edward's Peak. The westernmost summit of Mount Stanley, conspicuous from Butiti, is also unnamed and unclimbed.

In one respect the Duke was unlucky. He never, when on the highest summits, enjoyed a view of the great lakes or a clear horizon. Now, Ruwenzori can be seen in intervals in the rains as far as Mbarara, some 70 miles to the east as the crow

flies. The explanation may be—at any rate, this explanation is suggested by the tales of previous travellers—that during the dry season on the mountain haze obscures the lowlands. Most of those who have approached Lake Albert Edward speak of its fogs. When we passed it the air between the storms was gloriously clear, except about Ruwenzori, and we saw distinctly the Sfumbiro volcanoes. Dr. David, the Belgian traveller, tells us that he saw them and the lake from a point 1400 feet below the top of Ruwenzori, on its western slope.

With regard to the traces of ancient glacial action, Dr. Roccati, the geologist who accompanied the Duke, confirms and enlarges my observations with the authority of an expert. He sees distinct traces of moraines near Bihunga and on the steep slope at the mouth of the upper Mobuku valley, 5 miles from and 6500 feet below the existing glacier. With regard to the blocks scattered still lower in the level valley at Ibanda, he, like me, hesitates to express a definite opinion as to their mode of transport. I shall be interested to ascertain if he is disposed to entertain my hypothesis of a flood caused by the bursting of a subglacial reservoir.

As regards the practical uses Ruwenzori may prove to have for Uganda, it will be discovered, I imagine, that it is not in the valleys below the snows, but on the broad upland slopes at the northern end of the chain, that sites for European cultivation and for a sanatorium may be found in the future.



MOUNT STANLEY AND MOUNT SPEKE FROM BUTITI.

I would ask map-makers to bear in mind two physical facts often misrepresented. The Kafuru straits, connecting Lakes Albert Edward and Ruisamba, are only 700 to 800 yards wide and many miles long. They are more accurately shown in Sir H. Johnston's maps than by any other cartographer. Next, the Ruwenzori range ends to the north in a bold spur thrown into the Semliki valley, and there is a deep recess between this and the escarpment which runs north from the neighbourhood of Fort Portal to the southern end of Lake Albert.

With respect to the main characteristics of the glaciers of the Nile, it will be seen that my own first impressions have been, as a whole, confirmed. The highest peaks reach very nearly 17,000 feet—the elevation Mumm and I first conjectured on the spot. I may note, parenthetically, that I did not (as has been quoted) assign to them 18,000 feet, but put the *possible limits* of their height as 16,500 and 18,000 feet, inclining myself towards the lower figure. I estimated the glacier region to be included in a circle 12 miles in diameter; on the Duke's map it is reduced to 10. As to the permanent snow-level, 14,400 feet, I am in exact accordance with the Duke. The snowy mass we saw from Butiti proves, as I wrote in May last, to be composed of the tops of the highest peaks (Mount Stanley) seen

over Duwoni (or Mount Baker). This summit is rightly known as "Johnston's Duwoni," since it is the peak he drew from Ibanda. But some confusion has arisen from the fact that, when at the head of the Mobuku valley, Sir H. Johnston thought the summits to the east of the icefall were identical with those he had seen from Ibanda (see Johnston's 'The Uganda Province,' vol. 1, pp. 158 and 187).

On the other hand, Dr. Wollaston's report led me into the erroneous belief that the highest peaks were not on the watershed. The Duke has cleared up and established the topography of the inmost portion of the group by his discovery of the importance of the long Bujuku valley. When we passed its opening mists and rain-storms hid the landscape; but it is strange that it should altogether have escaped the British Museum party, for whom it might have proved a happy hunting-ground during the weeks they spent at Bihunga. The Duke has also shown that all previous travellers were in error in regarding the crest at the head of the Mobuku glacier (Moore glacier) as part of the watershed.

In the foregoing remarks I have been greatly assisted by the superb panoramas and photographs presented to me by my former companion in the Himalaya, Signor Vittorio Sella. The perfect panorama from King Edward's peak (Kiyanja) is a masterpiece of mountain photography, which rivals his "Caucasus from Elbruz," or his "Kangchenjunga from the North-West."

It is not uncommon, even in unexpected quarters, to find it assumed that "a mountaineering party" is incapable of rendering any return to geography and science. Mountaineers may point, in Ruwenzori, to an instance where they have succeeded, after many experienced travellers, who were not mountaineers, had failed, in lifting the veil of centuries and giving the world accurate knowledge of a most interesting and fascinating region—the Snows of the Nile. The Duke of the Abruzzi and Signor Sella have done for the region above the snow-level what Sir H. Johnston had previously done for the lower zone of forests and flowers.

A NEW BRITISH ANTARCTIC EXPEDITION.

By E. H. SHACKLETON.

I AM at present organizing a new expedition to the South Polar Regions. My purpose is that this expedition should leave New Zealand at the end of January or beginning of February, 1908. The expedition will, unlike that of the *Discovery*, consist of a small shore party of nine to twelve men, who will winter at the winter quarters of the *Discovery*. The ship will either be a whaler, specially chartered or purchased, or a full-powered steamer, capable of doing 10 knots, which will not leave New Zealand until February, when the sea in the South is free of ice. On landing the party, the vessel will return to New Zealand, and the charter will be up until the following year. There will thus be no risk of the ship being frozen in, and there will be no responsibility to those at home.

The funds at present at our disposal admit of the following programme.

The shore party of nine or twelve men will winter with sufficient equipment to enable three separate parties to start out in the spring. One party will go east, and, if possible, cross the barrier to the new land known as King Edward the Seventh's Land, follow the coast-line there south, if the coast trends south, or north if north, returning when it is considered necessary to do so. The second party will proceed south over the same route as that of the southern sledge party of the *Discovery*; this party will keep from 15 to 20 miles from the coast, so as to avoid any rough ice. The third party will possibly proceed westward over the mountains, and, instead of crossing in a line due west, will strike towards the magnetic pole.

The main changes in equipment will be, that Siberian ponies will be taken for the sledge journeys both east and south, and also a specially designed motor-car for the southern journey. A North China or Siberian pony is capable of dragging 1800 lbs. on a food basis of 10 lbs. per day. A dog drags 100 lbs. at the outside, and requires over 2 lbs. of food a day. Therefore, one pony drags as much as eighteen dogs at less than one-third in weight of provision, and can travel comfortably 20 to 25 miles a day.

The motor will be of a special type, taking into consideration the temperatures to be encountered and the surface to be travelled over. I would propose to take three or four ponies on the southern journey, and the motor-car. As long as the car continued to remain satisfactory, it alone would be used to drag our equipment and provisions. If it broke down and could not be fixed up, then the ponies would take over the load.

I would propose travelling at the rate of 20 to 25 miles a day, and feel assured that, providing the motor does its work, we could reach with it a point beyond 82° 16′ S. I intend, every 100 miles, to drop a sledge-load of provision and equipment, so that, in the event of every means of traction breaking down except by men, we would only have 100 miles to go between each depôt on return. The geographical south pole is 731 miles from winter quarters, and allowing that we only go with the motor to 82° 16′, we would then practically be starting for the remaining 464 miles as fresh as if we were starting from the ship. What lies beyond 83° S. we cannot tell, but I am of opinion that we can follow the trend of the southern mountains for a very long way south, before they turn either east or west. Should they turn to the eastward, and we find it impossible to get over them with the ponies, we would pull the sledges ourselves up the nearest available glacier. If no way up the mountains is found, we would continue following them round to the eastward, until we found it necessary to return towards winter quarters. If, on the other hand, the mountains turned to the west, we would continue straight south, and, if the surface were favourable, would increase the distance between our depôts to 150 miles, to

admit of a more extended journey. On reaching the geographical pole, we should strike at an angle about north-west, and so pick up the mountains to the westward. When it became necessary to return, we would then strike due east, and begin picking up our last depôts.

I do not intend to sacrifice the scientific utility of the expedition to a mere record-breaking journey, but say frankly, all the same, that one of my great efforts will be to reach the southern geographical pole. I shall in no way neglect to continue the biological, meteorological, geological, and magnetic work of the *Discovery*. Should we have sufficient funds, we would land a small party of men at the nearest available point to the south magnetic pole. When the time came for sledging, they would move over the mountains towards the pole, taking careful observations the whole time, and if good fortune attends them and they reach the pole, they would survey the magnetic area as far as possible. During their winter stay in the vicinity of Mount Melbourne, the magnetic instruments would be running, and the meteorological observations would be taken at the same time as they would be taken in our winter quarters, so that a comparison could be made afterwards. If possible, in the winter quarters, where also magnetic observations will be taken, we would have a small launch in use for the remainder of the summer, in which the biologist could do marine dredging in a more continuous way than we were able to do on the *Discovery*. As regards geology, the wintering party by Mount Melbourne would have a new field to work on, and I would propose that careful observations and collections be made in all departments, the results of which could be worked out by those at home more qualified to do so than the field workers; and if the expedition proves a success, we intend to publish in as complete a manner as possible all the scientific results. By this means I would hope to have an expedition that will not only be successful in the field, but will make a mark in the scientific world on its return.

On the return of the vessel in February, 1909, the first party to be picked up would be that in the far south; the second party, at Mount Melbourne, would be picked up on the return. Should I only have a full-powered steamer of steel, it would not be possible for me to risk the approach to Mount Melbourne; but I hope through friends who are interested in this work to increase the scope of the expedition. Then, having a whaling vessel—which even now I may get—I propose, after picking up the party at Mount Melbourne, to proceed north of the Balleny islands, come down south again at the longitude where the *Discovery* turned north, and keep in as far south as possible to trace the north-western coast of Wilkes' Land, going as far west as possible before it is necessary to turn north. If we could settle the exact coast-line of Wilkes' Land, it would be a great help to geography. By the southern and eastern sledge journey we may possibly solve the problem

of the great ice-barrier; by the journey along Wilkes' Land we may lay down a definite coast-line; by the charting of new mountains and discovery of new lands in the far south we aid geographical science; by the magnetic work we help not only the academic side of magnetic science, but we may help the mercantile community in the way of better variation charts.

As regards *personnel* this is not yet settled, but I hope that some of those with whom I was associated before will come again, so that their training and experience of from 1901–4 will be available. I would like to add that, if possible, during the winter, we should try and watch the breeding and nesting of the emperor penguins.

As regards equipment, which I have worked out, I can say but little now, and this is not the place for it; but such things as a cinematograph for showing the movements of the penguins, and a phonograph for recording their cries, will be amongst the things taken to give our countrymen at home a better knowledge of the natural history of the place.

THE KINGSTON (JAMAICA) EARTHQUAKE.

On June 7, 1692, the island of Jamaica was visited by an earthquake of great violence and extent. Throughout the island destruction was general, houses were overthrown, fissures opened in the ground, the mountains were scarred with landslips, and at Port Royal, then the capital of the island, a tract of 1000 acres was submerged beneath the sea to depths of 4 to 6 fathoms, while other parts underwent little or no change of level. How far this subsidence was due to the settlement of unconsolidated surface deposits is uncertain, but the earthquake was evidently of the same type as the Californian one of last year or the Alaskan of 1899; there may well have been movement along fault lines, like those described by Messrs. Tarr and Martin in this *Journal* of July last, and in this way a considerable subsidence of one part of the town may have taken place while the rest was but little affected in this respect. Be this as it may, the area available for building was so much reduced that a part of the population had to migrate and establish itself at Kingston, which became in time the capital of the island, and now, by the irony of fate, was itself destroyed by an earthquake on January 14, 1907.

Though it has attracted as much attention, and filled as much space in the daily papers as the Californian and Chilian earthquakes of last

year, the Kingston earthquake was of a very different character and order of magnitude. In the former case, the focus and the zone of destruction were measured by hundreds of miles; in the latter, the damage was practically confined to three parishes, according to the Governor's report, but these three parishes comprised the busiest and wealthiest districts of the capital, and in them destruction seems to have been almost complete, and far more thorough than in San Francisco or Valparaiso. The shock was, in fact, very similar in character to that which destroyed Casamicciola in 1883—that is to say, of great intensity but small extent; the Ischian earthquake was barely felt even at Naples, and the Jamaican one does not seem to have been generally felt in the island. It is possible that earthquakes of this type are more common than is thought; as a rule, they would escape notice owing to their small extent, and it is only when a town happens to lie within the limited area of great evidence that they attract general attention.

A question which has arisen in connection with the repeated reports of destructive earthquakes during the last year or so, is whether there is in reality any increased instability of the Earth. This supposition has found common acceptance of late, and been strengthened by the paper lately read to the Royal Society of Edinburgh by Lord Kelvin, in which he pointed out that, on the hypothesis of a solid, heated, and cooling Earth, volcanic activity should become gradually less, and seismic action greater, as cooling progressed; but it must be borne in mind that the change contemplated by this hypothesis must be extremely slow, and it is hardly probable that any noticeable change could have taken place within the historic period, certainly not within the memory of living man. The supposition that earthquakes are increasing in violence finds no support, therefore, in theory, and still less in actual fact when this is carefully examined.

A score of years ago, or less, when the possibility of knowledge was confined to such earthquakes as could be felt, the occurrence of four destructive earthquakes within a twelvemonth might have led to false conclusions, but, with the advent of the new seismology, and the setting up of numerous instruments capable of recording distant earthquakes, we now know that many earthquakes, as severe as any of the recent American ones, occur each year, but escape common notice through their origin being under the sea, or in sparsely populated or uncivilized parts of the Earth. For some years past Prof. Milne has recorded the tale of these great earthquakes each year in the Reports of the British Association, and from these we find that the number of great earthquakes was 110 in 1899, 117 in 1900–01, 69 in 1902, 64 in 1903, 35 in 1904, 59 in 1905, or an average of 66 great earthquakes a year.

From these figures it will be seen how insignificant is the total of the earthquakes which have made such an impression on us as compared

with those which pass unnoticed. The figures for 1906 are not yet available, it is not improbable that the total will be above the average, or it may be less, but no conclusion can be drawn from the fact that a small proportion of the great earthquakes of last year happened to find a large town within the area of their destructive powers. So far as facts go, there is no reason for supposing that any particular town or city is either more or less liable to destruction by earthquakes than it has been in the past.

R. D. O.

REVIEWS.

EUROPE.

Mackinder's Britain.

'Britain and the British Seas.' By H. J. Mackinder. Second edition. Oxford: Clarendon Press. 1907. *Price 7s. 6d. net.*

Since its first appearance five years ago, this work has held the field as the only serious attempt yet made to picture the physical conditions of the British Isles in such a way as to bring out clearly the influence which those conditions have had on the human societies dwelling in them. Those, even, who may have been inclined to question the validity of some of the theories advanced, or the deductions made from them, have freely recognized the force with which the author's views were presented, and the unity of purpose and grasp of principles displayed in the whole treatment of the subject. The appreciation which has been accorded to the book is shown by the comparatively short time within which a new edition has been called for. During that space nothing has occurred in the field of geography calling for any radical change of standpoint, and the work is to all intents and purposes the same in its second as in its first edition, while at the same time it has been subjected to a careful revision in matters of detail. Of the minor alterations, some have been made in deference to criticisms and suggestions by reviewers and others. Thus the term "Cheshire gap," to which exception was taken in the review which appeared in the *Journal*, has been replaced by "Midland gate"—the term adopted by the R.G.S. Committee on the nomenclature of the physical features of England. On various other points the author has naturally shown himself unconvinced, and in particular has adhered to the general arrangement of the chapters, which some had criticized as not strictly logical. The additions in the present edition consist in great part of notes at the end of the chapters, calling attention to the results of research, published since the first appearance of the book, or supplying further elucidation of special points. Some new matter is, however, incorporated in the text of the chapters, especially those dealing with the evolution of the river systems, and with ethnographical and historical geography, on which subjects research has perhaps been more active than on others. The fisheries of the British seas also receive fuller treatment. Students may thus feel assured that the book is in every way abreast of the time,

and it will no doubt long remain an indispensable source of inspiration to all who desire to work out the relations between man and his environment within these islands.

ASIA.

The Malay Peninsula.

'British Malaya: An Account of the Origin and Progress of British Influence in Malaya.' By Sir Frank Swettenham, K.C.M.G., late Governor of the Straits Colony, etc. London: John Lane, The Bodley Head.

The author of this instructive book, in his preface, remarks that though we have no special school for such training, yet Englishmen excel as administrators. He rightly connects this aptitude with our geographical position, which necessitates well-trained sailors, who, from early life, are accustomed to face the unexpected with equanimity. As he says, "it would be difficult to devise any responsibility, however onerous and unattractive, which a midshipman would not at once undertake, though it had no concern with sea or ship. . . . One may, however, question whether any one but a midshipman would have willingly embarked upon a voyage to discover the means of introducing order into the Malay States when that task was thrust upon the British Government in 1874."

The volume tells how this was done, and the story is as creditable to all concerned as it is gratifying to our national pride. For, to put it mildly, without encouragement from officials at home, and in spite of warning that if the limits of masterly inactivity were exceeded, the local officers would have to take all risk and bear all blame, yet they preferred responsibility to impotence. They boldly took the initiative in reform, and, when distrust was allayed, were completely supported by the Malays.

There are many States in the peninsula: some in the Straits Settlements (a crown colony), others under Siam, and those known as the Federated Malay States. The last group supplies the chief interest of Sir Frank Swettenham's book, whence the steps from chaos to prosperity may be traced. Not least among the factors of success were the Chinese, who worked the tin-mines. French and other European companies were formed for the purpose; "but it was the Chinese who began the work, who have continued it ever since, and whose efforts have succeeded in producing more than half of the world's tin supply. Their energy and enterprise have made the Malay States what they are to-day, and it would be impossible to overstate the obligation which the Malay Government and people are under to these hard-working, capable, and law-abiding aliens. . . . But the Chinese were not only miners; . . . as contractors, they constructed nearly all the Government buildings, most of the roads and bridges, railways, and waterworks. They brought all the capital into the country when Europeans feared to take the risk; they were the traders and shopkeepers; . . . and it is their work, the taxation of the luxuries they consume and of the pleasures they enjoy, which has provided something like nine-tenths of the revenue." This tribute to the race in Malaya may with advantage be considered, and its lesson be applied elsewhere.

The funds obtained from mining operations were used to develop the country; roads, railways, irrigation, and jungle clearance were proceeded with, and cultivation followed. Para rubber was planted on a considerable scale, with results so profitable as to encourage young men with a taste for open-air life and adventure to seek their fortune in these States. The book is attractively got up, and the illustrations deserve special praise.

W. B.

The Climatological Atlas of India.

'Climatological Atlas of India.' Published by the authority of the Government of India, under the authority of Sir John Eliot, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India and Director-General of Indian Observatories, Issued by the Indian Meteorological Department, 1906, . . . through Messrs. John Bartholomew & Co., Edinburgh.

The Indian Meteorological Service is the largest and most complete system of the kind in the tropics, and its history, as outlined in the Introduction to the Atlas under review, is a record of steady improvement and progress. The history is divided into three periods: that previous to 1864 or 1865, when such observations as were made were local, and arranged upon no system; that between 1865 and 1875, when the work was organized on a provincial basis, and was still lacking in completeness and comparability; and, finally, that from 1875 to date, when the organization was imperial and directed from a central office. It was only in the last period that the observations, as a whole, reached such a general level of uniformity and accuracy as could warrant the detailed treatment necessary to turn them to account in establishing the climatology of India.

The last quarter of the nineteenth century is the period for which the various elements of climate have been worked up, and this work also falls into three parts: the elaboration of the figures of actual observations so as to yield numerical means and extremes, the results of which have been published in various volumes of the Indian Meteorological Memoirs since 1901; the Atlas now before us, giving cartographical expression to the data formerly published in Tables, and a 'Handbook of the Meteorology of India' which is promised, and in which the bearings of the whole work will be authoritatively set forth. Meanwhile, the Atlas is prefaced by a certain amount of letterpress, though not enough to make it independent of the memoirs of the past or the handbook of the future. While the meteorologist must of necessity refer back for much essential information, and summon his patience to wait for some desirable generalizations, the geographer, at least, may accept this Atlas as a single and substantial gain to his knowledge, and proceed in its light to rearrange his ideas of Indian climate.

The organization which made the Atlas possible deserves to be referred to. The commission appointed to inquire into the Orissa famine of 1866, recommended that Prof. Tyndall should be invited to come to India "and develop meteorological inquiry." This, apparently, was not done. In 1871, after considering memoranda from Mr. H. F. Blanford and Sir Richard Strachey, the Indian Government consulted the Council of the Meteorological Office in London,* which suggested a scheme for reorganization. The Indian Government accepted this scheme, and appointed Mr. H. F. Blanford as imperial reporter, entrusting to him the carrying out of the new system. Mr. Blanford continued to direct the work, extending the system of observations to the larger native states and improving details; but the record of the work of the department becomes more impersonal as it proceeds, and the date at which Sir John Eliot succeeded Mr. Blanford is not mentioned. Sir John had, however, been meteorological reporter for the province of Bengal since 1874, so that his personal labours in a responsible position in India extended over

* Presumably the body consulted was the Meteorological Committee of the Royal Society, which was responsible for the Meteorological Office from 1867 to 1877.

the whole period dealt with in the Atlas, and there is certainly no one else with such a grasp of the whole vast subject as he.

With the meteorological aspects of the work we have at present no concern. The question of the trustworthiness of native observers, the problem of the proper exposure of instruments, the methods of reduction and correction are all considered and settled in the volumes of the Indian Meteorological Memoirs, and we have only to see how these data, which are unquestionably the best that could be had, have been brought together in the form of maps, and what these maps teach regarding the climate of India.

The Atlas, which is produced by Messrs. John Bartholomew & Co., of Edinburgh, is similar in size, and in the execution of the 120 plates of maps, to the volume on Meteorology in Bartholomew's great 'Physical Atlas,' except that the binding is in plain cloth, which will doubtless prove more enduring than leather, and the paper on which the letterpress is printed is too thin for the great size of the page.

A series of general maps serves as an introduction to the special plates dealing with climatology. First come two double-page maps of the Indian Empire on the scale of 1 : 10,000,000; the first showing the configuration by a striking series of graduated tints which bring out the contrast of the Central Asian plateau, over 10,000 feet in elevation with the plains and hills of India; the second giving the larger features of the complex political geography. The physical geography of India is a fact of such supreme importance that it is very properly carried through all the climatological maps by means of contour-lines and faint black tinting, quite unobtrusive, and in no way spoiling the effect of the special colouring, but quite distinctly there when looked for. As is well known, the figures of atmospheric pressure and temperature are usually charted after reduction to their calculated values at sea-level; but the uncertainty of the correction at great heights is so considerable that Sir John Eliot has wisely refrained from utilizing, in this way, any data derived from stations at a higher elevation than 3000 feet above the sea. The practical result of this is to limit the scope of the maps to India proper, and to stop all climatological colouring on the slopes of the Himalaya short of the great Tibetan plateau. We are glad to note that for the purpose of this Atlas Ceylon is included, as it should be, in representing the distribution of atmospheric phenomena. Two plates are occupied with four maps showing subdivisions of India adopted for various statistical purposes, and then follow two double-page charts of the Indian ocean, illustrating the general distribution of pressure and the direction of the winds at two opposite seasons—January and July. These are most interesting and suggestive, for they show the climatological solidarity of the British Empire around the Indian ocean, illustrating the interdependence of the climate of India with the climates of Singapore, Hongkong, Borneo, New Guinea, and Australia on the one side, and those of Aden, Somaliland, British East Africa, Zanzibar, Mauritius, and South Africa on the other. The great annual overturning of the atmosphere which drives the air in January—the northern winter and the southern summer—from Asia southward over India, across the equator towards Africa and Australia, and draws back the air in July—the northern summer and the southern winter—from Australia and Africa, across the equator to India, really dominates the climate, not of India only, but of all the Indian ocean, and these striking plates exhibit the surge of the air in a really impressive way.

After the introductory maps, which deal with arrangement and general principles, come masses of orderly detail set out more fully than for any other country. As a rule, thirteen one-page plates are devoted to each special subject, representing the distribution for each month and for the year as a whole. The page is usually

shared by three maps, the natural scales of which are unfortunately not given; but one representing the condition at 8 a.m. is on the scale of about 225 miles to 1 inch; the other two, representing in less detail the conditions at 10 a.m. and 4 p.m., are on the scale of about 450 miles to 1 inch. The charting of mean meteorological conditions for two hours of the day, showing the full effect of the diurnal range, is quite new, and places this atlas above every other work of the kind. The number of stations yielding records and the duration of the periods from which "normals" are calculated differs somewhat for the different elements; but in every case the number of stations is relatively so small that the lines of equal value which are drawn must be viewed as only roughly approximate.

The first element dealt with is barometric pressure and wind, and while the large map enables one to follow the changes from month to month in detail, the two smaller maps remind one of the large diurnal range which is constantly at work altering the force of the wind at every hour of the day and night. Thus it appears that the average pressure over India varies as much between 8 a.m. and 4 p.m. every day in April (to take an example at random) as it does at 8 a.m. in a whole month during the gradual annual change. The next series of thirteen maps shows the average daily pressure for each month on the larger scale, and the diurnal range expressed in two different ways on the two smaller maps. Tropical meteorology differs from that of temperate countries in nothing so much as in the regularity and extent of the regular diurnal range of pressure between morning and afternoon, and this series of maps gives much new matter for study.

Temperature maps follow, the first thirteen showing the mean temperature of the day, the mean maximum and the mean minimum of each month; bringing out with quite startling vividness how the area of greatest warmth moves north-westward across India as the season advances, until the Punjab and the extreme north-west which were the coolest part of the peninsula in January, have become the hottest in June; showing, too, how in India the south or most nearly equatorial portion is the coolest part of the country in the hottest months, the influence of height above sea-level being allowed for. Thirteen maps show, in the first place, the distribution of diurnal range of temperature for every month, and, in addition, the absolute maximum and absolute minimum temperatures for the month. The range is remarkable; thus in January there are maxima exceeding 97°·5 in South India, and minima falling short of 25° in the north-west, whereas in June and July there are maxima exceeding 125° in the north-west and minima below 65° in the south.

The next set of thirteen plates deals with relative humidity, a condition which is not so frequently charted as its importance deserves. The distribution is always such that the highest percentage is found in the north-east and round the coast, the lowest in the interior and towards the north-west, but the centre of minimum relative humidity moves farther into the north-west angle of the country as summer advances. The range in relative humidity between 9 a.m. and 4 p.m. is very striking, being dependent, of course, on the great range of temperature. Unfortunately, the readings of the wet-bulb thermometer, on which the humidity observations depend, are the least satisfactory of the elements of climate observed, and there is less certainty about the results than in the case of pressure and temperature. A second series of thirteen plates deals with the absolute humidity or total amount of water-vapour present in the atmosphere irrespective of the temperature or the probability of condensation. While the relative humidity is the more important condition in its relation to practical matters of health and agriculture, the absolute humidity has a special value in meteorological discussions, and its variations from month to month show a close relation to the seasonal changes of wind.

A beautiful series of thirteen plates shows the proportion of the sky covered with cloud, on the average of the day, at 8 a.m. and at 4 p.m. The colouring shows small amounts of cloud in tints of blue, large amounts in shades of brown, forming in this way almost a picture of the state of the sky. The resemblance with the relative humidity maps is, of course, very close, although the cloud-maps represent the approach to saturation in a much higher stratum of the atmosphere than that dealt with by the wet-bulb thermometer. In the cold weather, from November to February, there are two areas of moderate cloud, one on the slopes of the Himalayas, the other in southern Madras; the country between the two is practically cloudless. In the hot weather the regions on which a strong sea-wind blows are heavily clouded, the regions most affected shifting with the seasonal changes of wind, but the north-west corner of India remains with the minimum amount of cloud all the year through.

The section devoted to rainfall maps is particularly interesting, for it is here that the influence of geographical conditions upon climate are most clearly marked. The effect of height above sea-level on atmospheric pressure and on temperature is carefully eliminated before the figures are placed on the map, but rainfall is charted as it falls. The general distribution of rain in India, depending as it does on configuration and on seasonal winds (or currents, as the Indian Meteorological Department prefers to call moving air as well as moving water *), is familiar in its broad features. The larger map for each month represents the normal rainfall in inches, the smaller maps give the number of rainy days (in India this means days with one-tenth of an inch or more) and the tracks of storm-centres crossing the country; and half a dozen additional plates present the rainfall of the various seasons. By taking account of the rainfall, it is possible to divide each of the fundamental divisions of the Indian year (those in which the north-east and the south-west monsoons respectively occur) into two parts. During the first half of the dry season, from December to February, in the cold weather rain occurs chiefly during the passage of shallow depressions across the north of India, bringing heavy snow on the northern mountains. The second part of the dry season or hot weather (March and April) has only light irregular rains due to local thunderstorms, but in Assam these rains are very important to tea-growers. From May or June to September the south-west monsoon brings a general rainfall over the whole of India except South-Eastern Madras and the extreme north-west. The remaining months of October and December have heavy rains round the Bay of Bengal as the monsoon retreats, while the greater part of India is dry.

The scale of the annual map of normal rainfall is too small to do more than indicate the broad general dependence of rainfall on configuration and wind direction, bringing out the general wetness of the coasts, especially the west coasts, and the general dryness of the interior, especially in three large areas, viz. the Indus valley in the north-west, the upper valley of the Krishna behind the Western Ghats in southern India, and the middle valley of the Irawadi in Burma. The detailed relationship between rainfall and configuration is not advanced by this work. We must confess, indeed, that the treatment of rainfall as a whole is a little disappointing. The omission of stations above 3000 feet deprives the map of much of its character, and in this department of climatology where geographical principles are

* In the text Sir John Eliot refers to "the great oceanic current of the south-west monsoon," meaning thereby the wind that blows over the land, not the water that flows in the sea. To use a technical term of oceanography without explanation or definition to describe an allied but totally different phenomenon in meteorology seems to us a mistake.

most closely concerned we miss the firm grasp which might have brought the data into a completer shape than they at present show.

With reference to the great advance now being made in our knowledge of the upper regions of the atmosphere, attention may be called to a series of small maps showing the pressure of the atmosphere at 10,000 feet elevation above India.

H. R. M.

AFRICA.

Rainfall in North-East Africa.

'The Rains of the Nile Basin in 1905.' By Captain H. G. Lyons, Director-General, Survey Department, Egypt. Cairo, 1906.

In 1905 several new rain-gauge stations were established in the Nile basin (making seventy-five stations in all), and returns showing the number of rainy days were also received from forty-four posts scattered over the Sudan plains. It is hoped that by collecting information from so wide an area, it may be possible to deduce the probable development of the East African monsun in its northern extension, though, as Captain Lyons says, "much study is still necessary before it can be said precisely what information is more useful, and what weight should be given to such evidence as excess or deficiency of rain in different areas."

The meteorological information given in this report is interesting and important, including a set of maps of the mean monthly rainfall over the region which show well the advance of the rains northward in early summer, and their return in the autumn across the equator. The northern edge of the equatorial rainbelt just reaches Khartum, which has its one short rainy season. The precipitation over the Nile basin in 1905 was deficient everywhere, with the exception of the Delta, which had a heavier winter rainfall than in 1904, owing to the passage of the Mediterranean cyclonic depressions nearer the African coast, and the Nile flood was only 0·65 of the average volume. This makes the tenth successive year of low floods, only two since 1895 having risen, very slightly, above the average, while the others were well below. Captain Lyons emphasizes the fact that the Nile water-supply is but little affected by the rainfall of the equatorial lake plateau, the evaporation in the marshy regions of the Bahr-el-Jebel and Bahr-el-Ghazal basins being so great that the run-off is only 0·95 per cent. of the precipitation.

AUSTRALASIA AND PACIFIC ISLANDS.

Plant-dispersal in the Pacific.

'Observations of a Naturalist in the Pacific between 1896 and 1899.' Vol. 2, Plant-dispersal. By H. B. Guppy, M.B., F.R.S.E. *Illustrations and Maps.* Large 8vo, pp. 627. London: Macmillan & Co. 1906. *Price 21s. net.*

This book figures as vol. 2 of Mr. Guppy's book on the Pacific, but it would perhaps have been as well had the two volumes appeared under distinct and differing titles. The first, it may be remembered, dealt with Vanua Levu, and was a comprehensive and most careful study of that island from a geological and physical point of view. It was, indeed, the trained geologist to whom it mainly appealed. The volume under consideration is for the botanist and the student of distribution, and though it may be as little intended for the layman as its predecessor, it has, it must be admitted, but faint connection with the latter. The place of "Vol. 2" on the back of the book is, however, taken by the customary two stars, so that the purchaser who wishes to confine himself to this latest record of Mr. Guppy's

investigations can do so without fear of any appearance of incompleteness in regard to his bookshelves.

All who have made any study of the Pacific are familiar with Mr. Guppy's work. He is a trained and careful observer, with wide experience and a good knowledge of his ground. For the writing of the volume before us he has qualified himself by a course of observation which is truly Darwinian in its patience and method. His interest in the dispersal of plants having been first aroused in his earlier cruises in the Solomons, he afterwards followed up his investigations while on Keeling island and in Java; continued them for some years in the British Isles, in the Mediterranean, and in Fiji; examined the west coast of South America from Southern Chile to Ecuador; and finally visited Panama in order to study the differences between the shore plants on either side of the isthmus. Even were Mr. Guppy not the competent naturalist that he is, so wide a course of study would alone be sufficient to compel our attention.

The book, as we have already said, is mainly for the botanist, and without a certain amount of acquaintance with the littoral flora of the Pacific islands, the reader will not find it very easy to follow the author in his arguments. He takes the floating seed as his text, and the plants on the sea-shore as his main study, and the years of investigation he has devoted to them have enabled him to build up a superstructure of facts which will serve for a long time to come as a perfect storehouse of information for future investigators to draw upon, whether they choose to accept his deductions or not. Although he is modest enough to describe himself as a plotter of detail rather than a delineator of great designs, and to lament that much of what seems new in his work has already been foreseen by the generaliser, there is no doubt that Mr. Guppy here gives us one of the most valuable studies on plant-dispersal hitherto published.

After recording numerous experiments on the buoyancy of seeds, their fertility after long immersion, and so forth, the British littoral flora is discussed at some length. The Fijian, Tahitian, and Hawaiian plants of similar situation are then treated of, before passing to the currents of the Pacific and their action, the *rôle* of birds, vivipary, the relation between shore and inland plants, and the eras in the floral history of the Pacific—a subject which extends over several chapters. There are also special chapters on beach and river drift, and on the economic plants of the Polynesian, and, lastly, a very interesting section on the Rhizophores—the different genera and species of mangrove having been a special study of the author. Some plants and trees of special peculiarity, such as *Afzelia bijuga*, *Entada scandens*, and some of the Cæsalpinias, are also dealt with separately. A final chapter gives a summary of Mr. Guppy's arguments and conclusions, and there is a long appendix of notes on the text.

Much of this, as may be supposed, is of technical interest only, but there is also much which bears directly on geography. Such, for example, are the pages on the west coast of South America, which form one of the most instructive portions of the book. Going northwards from Valdivia, Mr. Guppy distinguishes four well-marked shore-belts: (1) the *Convolvulus soldanella* belt, with cool moist beaches (South Chile); (2) the desert, plantless belt, where the temperature of the sand near the surface ranges from 120°–130° Fahr. (North Chile); (3) the Sesuvium belt, ranging from Africa to near Tumbez in lat. 3° 30′ S., which has a beach quite as hot as that of the desert belt, but shows a scanty flora in which one or two species of Sesuvium are generally to be found; and lastly, (4) the mangrove belt of Equador and Colombia, where, near Tumbez, there is an abrupt transition from drought and semi-sterility to humidity and rank tropical vegetation. A very remarkable feature, however, is to be noticed in this belt, for it is interrupted from Puna island to the

equator, a distance of some 200 miles, by a stretch of perfectly arid coast, which resembles the sterile sea-coast of Peru and has similar climatic conditions. These striking variations, noticeable even by the most unobservant traveller passing along the coast, have been remarked upon by many naturalists, especially by Ball and Eggers, though not many have dealt with the subject so fully as the author. His explanation of them deserves to be recorded here, as it differs in many respects from that given by previous writers. He regards the aridity of the tropical coasts of Northern Chile and Peru, and the complete absence of the mangrove, as caused by the prevailing wind having to cross the cold waters of the Humboldt current before striking the land. Over the current mists are of frequent occurrence, and on attaining the land the air does not part with any more moisture till it has climbed the mountains and reached a cool temperature many thousands of feet above the sea. The Humboldt current is thus the condenser—the umbrella, so to speak, of this western coast, and that this is so, Mr. Guppy considers, is proved by the fact that when the Humboldt current leaves the coast below Tumbez mangroves thrive, but when it strikes it again beyond Puna island, and courses along it to the equator, we find the remarkable arid stretch of sea-coast above alluded to.

We should like, if space permitted, to follow Mr. Guppy in his discussion of the former sea connection across Central America, and other questions of a geographical nature upon which light is thrown by study of the strand flora. Here, as elsewhere, the author supplies abundant and suggestive material. Perhaps, indeed, the material is a little too abundant, or rather the presentment of it, for the volume does not sin on the side of conciseness, and its message might have been delivered still more effectively with a reduction by a century or so of pages. However, this is atoned for by the excellent plan of summarizing the arguments and conclusions of each chapter at the end of it. Mr. Guppy now and again touches upon evolution, chiefly to reiterate his assertion that the world is only a differentiating world, and that Nature nowhere enlightens us as to the mode of development of the type itself. Into this branch of the subject, however, we need not follow him.

F. H. H. G.

THE MONTHLY RECORD.

THE SOCIETY.

President Roosevelt and the R.G.S.—At the meeting of the Society on February 11, the President read the following letter from the Hon. Theodore Roosevelt, President of the United States, who a short time ago was elected an Honorary Member of the Society: "I very deeply appreciate the compliment conferred upon me by my election to honorary membership in your great and distinguished Society—a Society standing pre-eminent among all organizations of the kind throughout the world. I thank you for myself. I thank you on behalf of the great English-speaking Republic of the Western Hemisphere for this compliment conferred upon its President." It may be mentioned that, including President Roosevelt, the list of honorary members includes only ten names in all, mostly representatives of the royal families of Europe and elsewhere.

EUROPE.

Some Lakeland Tarns.—In the *Geological Magazine* for September, 1906, Messrs. Rastall and Smith described their examination of some small tarns on the Haystacks mountain, near Buttermere, which present some interesting features. The upper surface of the mountain is very irregular, with many small peaks and intervening hollows, and presents many evidences of glaciation, the ice having evidently moved from the south-east. The largest tarn, Blackbeck, is about 250 yards long, and drains over the crags on the north side of the mountain into the Warnscale beck, one of the main feeders of Buttermere. The tarn is pronounced to be not a rock-basin, but to be held up by some kind of loose material which blocks the outlet, this being apparently morainic rather than scree. Beneath this material traces of an old buried channel, once the outlet, can be seen. Another tarn, called by the writers "Haystack," for want of a recognized name, contains several islets of rock *in situ*, and is surrounded by very fine *roches moutonnés*, evidently formed by ice coming from the south. At present it drains in this direction over rock, but there are indications of a former outlet, now blocked by loose material, in the north-east corner, so that this too is probably not a rock-basin, as might have been supposed. On the southern side of the mountain there is a somewhat remarkable pool, occupying the portion of a peat-hag which has been hollowed out in some way or other. Small islands of peat project above the water, and are all remarkably undercut, as if by wave-action, to which it seems necessary to attribute the origin of the tarn, though the excavation of the former surface of the peat may have been assisted by desiccation and the removal of matter as dust during dry periods. Such a reversal of the usual process of peat-accumulation is certainly interesting, and may possibly be a cause of the formation of lake-basins, on a small scale, in other districts.

Disappearance of the Wolf in France.—The diminution of the number of wolves in France is the subject of a note in the *Tour du Monde* (December 29, 1906). The author recounts the various laws that have been passed for their destruction, and then, with the assistance of two maps, shows the great progress that has been made since 1889 in exterminating these pests. Whereas in the former year the "wolf district" stretched from Ain, in the north, due south to the borders of Haute Savoie, and then west between the Loire and the Garonne, to the sea, in 1906 this district had been cut in two and diminished by more than a third. The author is of opinion that before many years have elapsed the wolf will be as unknown in France as it is in England.

Rügen and the Strelasund.—The island of Rügen is separated from the mainland by a narrow channel known as the Strelasund, on the south-western side of which lies the town of Stralsund. Prof. W. Deecke, who has for many years made a special study of the structural features of the island and its vicinity, and has shown in various papers that it is a "Schollenland," or one broken up by fractures into a number of separate blocks, with a general direction from north-west to south-east corresponding to the Hercynian system, has lately obtained evidence that the origin of the Strelasund is likewise (as had been previously suspected) due to similar causes (*Sitzungsberichte K. Preuss. Akad. Wissenschaften*, 1906, No. 36). Borings for a well at the railway station at Altefähr, on the Rügen side of the Strelasund, have yielded samples of the underlying Cretaceous rocks, which have been submitted to careful examination, and found to belong to the Upper Turonian, an older member of the Cretaceous system than that occurring on the opposite side of the Strelasund, which is, like the rocks of the greater part of the island, of Upper Senonian age. The writer gives various reasons for supposing that a dislocation has taken place along the line of the Strelasund (north-west to south-east), by which the rocks on the south-west side have sunk relatively to those on the north-east. Similar and

parallel lines of fracture follow the north-eastern side of the island, and the line of the Jasmunder Bodden, and a fourth possibly occurs between the latter and the Strelasund. The depressions along two at least of these lines of disturbance seem to be now partially filled by Tertiary deposits. In its geological history, Rügen certainly belongs to the Danish zone of the Baltic, being divided from the region to the south-east by the transverse line of fault traversing the Oder estuary.

ASIA.

Dr. Sven Hedin in Tibet.—News arrived early in February, *viâ* Calcutta, of Dr. Sven Hedin's arrival at Ngangon-tso on January 21, after accomplishing a successful piece of exploration in Western Tibet. Details of the route followed are not yet forthcoming, but the traveller, who, it will be remembered, entered North-West Tibet last year by way of the Aksai Chin, says that he has crossed the country diagonally, exploring 840 miles of hitherto unknown country, and bringing to light many new lakes, rivers, and mountain ranges. Ngangon-tso, according to existing maps, lies in about 86° E., forming one of the series of lakes stretching west from Tengri-nor, on or near the route of Nain Singh, in whose map it was already shown hypothetically. As in his previous journeys, the traveller has secured an abundant harvest of cartographical, geological, and other scientific results, and has sounded some of the lakes on his route. He experienced very severe climatic conditions during the past winter, and lost all his baggage animals, though all his men got through in safety. On arriving at Ngangon-tso he was at first stopped by the Tibetans, but was soon allowed to proceed. At the time of writing he was on his way to Shigatse, which he hoped to reach at the end of February.

The Count de Marsay's Journey in Western China.—A journey from Tongking to the Upper Yangtse region was made last year by the Count de Marsay, accompanied by his friend, Count L. de Las Cases (*La Géogr.*, vol. **14**, p. 238). From Yunnan-fu northwards the travellers surveyed a route which, Count de Marsay says, had been followed by no European except Père de Guébriant, whose company they had for the journey. They crossed the Yang-tse at a point almost on the meridian of Yunnan-fu, and proceeded by Hwei-li-chou to Ning-yuan-fu. Hence they started west, intending to make for the great bend of the Yang-tse, but their progress was blocked by the great range which bounds the Yen-tsin plateau to the west, and which is crossed by no Chinese route. Bending to the north-west, they reached Yun-lin, a district embracing a number of small villages scattered over the mountains, and governed by a native chief recognized by the Chinese. The people belong to the Mosso race. Crossing a pass over 13,000 feet in altitude, they reached the Yangtse just at the apex of its bend. Returning *viâ* Yun-lin, the travellers visited the Wa-li gold-mines, and crossing and recrossing the Yalu in its great northern bend, made their way to Chentu, and down the Yangtse to the sea. Count de Marsay says that he made a compass survey of the hitherto untraversed parts of the route which will rectify various errors in our maps. It is not quite clear, however, whether he is acquainted with the work of all his predecessors (especially British) in the region visited.

Survey of Ceylon.—The Surveyor-General of Ceylon, in Part I. 'Civil Administration Reports,' 1905, reports that during that year the "rubber boom" upset current progress and order of surveys. In view, however, of the dependence of the extension of rubber cultivation on survey work, some sacrifice in the ordinary routine work was justifiable. The field survey in 1905, to the exclusion of all office out-turn, covered in all 455,578 acres, including 157,348 acres block, 217,600 acres of one-inch and contour, and 41,600 acres of other topographic surveys, and

39,030 applications, etc. In 1900, 2,885,845 acres were overtaken by field-work, the area of such work having since been in steady diminution. On account of sickness in the staff, the completion of the field-work of Uva province, so far as carried out by the "one-inch" staff, was just missed. The contour surveys were confined chiefly to the "railway zone." The final location, however, of the railway trace to Passara is to be postponed till the completion of the contour surveys to that place. The country is a very difficult one to run a line through, and it is still a question whether there is any route by which a railway to Passara would prove financially satisfactory to all concerned. A map of Nuwara Eliya, already five or six years in hand, only awaits for its completion a considerable amount of draughtsmanship. The coast road to Arugam bay is under survey, with a view to preventing the absorption of road reservations by landowners. The construction of a new road parallel to the existing one, and running mostly through Crown land, is under consideration. An experiment in coconut cultivation on a large scale in the North Central Province has had to be abandoned. A map of Ceylon, 16 miles to an inch, shows roads, cart-tracks, railways, and surveys 1897–1905, as also proposals for 1906. There are, besides, minor maps, showing the progress of surveying in the different provinces, and numerous photographic views.

Prof. Musil's Map of Arabia Petræa.—The Imperial Academy of Sciences in Vienna has just published a map of Arabia Petræa based on the observations of Prof. Alois Musil, whose researches have already been referred to in the *Journal*. The large map comprises those parts of Palestine, the Sinai peninsula, and Arabia known from the Bible and other history as the land of the Moabites (east of the Dead sea), land of the Amalekites, later Idumæa (south-west of the Dead sea), and land of the Edomites (south of the Dead sea). In its southern part, as also in its entirety, the land is known as Arabia Petræa. The region extends from the north end of the Dead sea to the Gulf of Akabah, and from 34° to 37° E. It is published on a scale frequently used for general maps of civilized lands, that of 1 : 300,000. A map of the environs of Wadi Musa (Petra), on the scale of 1 : 20,000, is also included. The three sheets of the principal map present a full nomenclature, especially for the east and south-east of the Dead sea, and this has been rendered possible only with aid of the fine workmanship of the Military Geographical Institute. The work is executed in three colours. Brown is used for hill-shading; blue for standing and flowing waters and aqueducts; black for temporary rivers and streams, as also for letterpress. Inhabited, half-inhabited, and deserted places are distinguished by distinctive symbols. The principal scientific value of the map lies not only in the corrections of and additions to the hitherto current conception of the region, but also in its wealth of archæological entries. Besides the modern telegraph-stations and halting-places on the New Mecca railway, there are found marked tells, ancient graves, roads in ruin, bridges, and walls. A large number of altitudes is also incorporated. The map represents a region to which renewed attention is now being paid, and it will, therefore, prove of general interest outside the circles of geographers and archæologists.

AFRICA.

Surveys in Northern Nigeria.—At the end of the present number will be found a map* of the districts on both sides of the lower Niger, in the neighbourhood of the Benue confluence. It is the work of Mr. D. Cator, of the Government service of Northern Nigeria, and is mainly based on surveys with prismatic compass, the latitudes of certain places (shown on the map by a distinguishing mark) being, however, fixed by meridian altitudes with the sextant. The basis is supplied by the

* Map, p. 368.

positions of Lokoja and Kabba as fixed by the late Lieut.-Colonel Vandeleur, and that of Ida as accepted in maps of Southern Nigeria. In the immediate neighbourhood of Lokoja the results of a rough plane-table survey are used, while some distances on roads have been fixed by means of the measuring-wheel. Mr. Cator also sends us some notes on the Egbira and Kukuruku districts of the Kabba province, which he visited in the course of his journeys. Some three years ago the people of the former, which lies off the main routes, gave trouble, and a punitive expedition became necessary. Mr. Cator was sent there subsequently (November, 1905), and remained three months, finding the people quite friendly. Having in the past been much raided for slaves, they have placed many of their villages in most inaccessible places, often at a great distance from, though within sight of, the fertile tracts which they cultivate with success. Palm trees flourish, but the practice of tapping them for wine prevents them from ripening their fruit. Parts of the country are densely populated, the village of Okeli alone containing 30,000 inhabitants, spread over a large area. Among their customs, Mr. Cator mentions that of piercing girls' upper lips and inserting a small piece of lead (though this metal is not found locally), which is supposed to favour child-bearing. Another is the payment by the bridegroom to the bride's family, apart from dowry, of 240 cowries (less than one penny in value), without which no marriage would be complete. Endless law cases are entailed by the non-return of this sum in the case of divorce or the remarriage of the widow. The Kurukuru country presents quite a different appearance to that of Egbira, containing many forest-covered hills. Iron, abundant throughout Nigeria, is smelted in many of the villages.

Return of Lieut. Boyd Alexander.—Lieut. Boyd Alexander, the sole European survivor of the expedition which started across Africa by way of Nigeria three years ago, reached this country early in February, having made his way from the French Congo territory to the Nile, emerging at Port Sudan on January 14 of this year. Lieut. Alexander will describe his journey at an evening meeting during the present session of the Society.

Major Powell-Cotton's Expedition to the Congo Forest.—Major Powell-Cotton, who, it will be remembered, started on his latest expedition to Central Africa over two years ago, accompanied by his wife, has arrived in Rome, whence some details as to the work accomplished have been telegraphed to this country. The traveller, whose principal object was zoological research, went south from the upper Nile through the eastern portion of the Congo State, spending a considerable time among the pygmies of the great forest, whom he carefully studied, obtaining many photographs, phonograph records, etc. He was fortunate enough to secure a splendid specimen of the rare white rhinoceros, and to bring to light at least six species of forest animals new to science. These are, the dusky African tiger-cat, about the size of a leopard, the honey badger or black Ituri ratel, the elephant shrew, a diving antelope armed with tusks, a new black-and-white monkey, and a huge red buffalo. The traveller did not see a living okapi, though once he was within 20 yards of one; but he sent home to the British Museum the skin and complete skeleton of an adult male, which appears to be the most perfect specimen yet brought to this country. Mrs. Powell-Cotton appears to have thoroughly won the confidence of the pygmies, of whose language she learnt a little, and among whom she did medical work. From the forest the expedition made its way to Lake Albert Edward, where the travellers made the acquaintance of a small community of lake-dwellers, whose houses are built on floating platforms. While on the banks of the Sassa river Major Powell-Cotton was severely mauled by a wounded lion, and narrowly escaped with his life.

French Expedition to Taodeni.—We alluded (*Journal*, vol. **28**, p. 508)

to the expedition carried out by Colonel Laperrine to Taodeni, in the inhospitable portion of the Western Sahara north of Timbuktu. The journey was made from the north, but it was arranged that a camel-corps detachment from Timbuktu should proceed at the same time to Taodeni, there to effect a junction with the northern party similar to that successfully accomplished two years before in a more easterly part of the desert. The southern party, which carried out its task with great pluck and determination in the face of great difficulties, was led by Captain Cauvin and Lieut. Cortier, the latter of whom gives a vivid account of the march and its results in *La Géographie* for December, 1906. The country between Timbuktu and Taodeni falls naturally into three zones. In the south the Azauad extends as far as a line through Arauan (the original destination of the detachment). After the first 15 miles the growth of trees ceases, and the country is traversed by lines of dunes running regularly (as throughout the whole tract up to Taodeni) a little north of east. The abrupt slopes here face the north, showing that the prevailing winds are from the south. In the Azauad the dunes are becoming progressively fixed by vegetation, owing to the moisture brought by the southerly winds. Pasturage for camels is found in the neighbourhood of Bu-Jebeha and Arauan, but north of the latter it becomes less and less, and for the greater part of the way to Taodeni—a distance of over 300 miles—not a vestige of vegetation is to be seen. The only water-supply, and that precarious, is at the well at Unan, and the party suffered severely during the passage from the excessive heat. At about 70 miles from Taodeni there is an escarpment falling sharply to the Taodeni basin, and forming the dividing-line between the second and third of the zones above alluded to. In the second the dunes have their steep faces to the south, so that the prevailing winds seem to blow from either side towards a line of low pressure about Arauan. North of the escarpment the surface of the plain is broken by rocky elevations falling in steps to the lower level, and seeming to mark the ancient level of this part of the desert. Arrived at Taodeni, the party obtained no news of Colonel Laperrine, and were obliged to begin the return journey without waiting for him. During the stay a visit was paid to the famous salt deposits, which had not previously been seen by any European. The salt, which is obtained by digging, occurs in successive layers separated by beds of clay. It is taken out in bars weighing some 70 lbs. each, of which 32,000 were transported to the south in 1905–1906 by the Berabish and Kunta caravans. The mines, which belong to no one, seem to have been exploited only during the last three hundred years, since the destruction of Taghaza, where salt was formerly obtained. At Taodeni itself there is no salt, and the water of the wells there has no saline taste, though charged with sulphate of magnesia. In order to lose no chance of meeting with the northern party, a portion of the force, under Lieut. Cortier, returned by a more easterly route through Gattara, where the desired junction was eventually effected. During the passage of the waterless tract south of this, Lieut. Cortier's party were driven to great straits, and a disaster was narrowly avoided. A result of the two expeditions has been to confirm the French authority in this region, and to place a check on the raids from the north to which it has been subject. The latitude of Taodeni was fixed by Lieut. Nieger, of Colonel Laperrine's column, as 22° 40′ 19″ N., or north of its position as laid down by Lenz.

Railway Survey in the French Congo.—Since the early days of the French Congo territory, when M. de Brazza suggested the construction of a railway from Loango to Brazzaville, a number of schemes for the opening up of the country by means of a railway have been mooted, but long remained without practical result. The question has lately been raised afresh by M. Gentil, who in 1905 suggested the survey of a route up the valley of the Ogowe, and across the divide to a convenient

point on the course of the Likuala tributary of the Congo. The idea was taken up, and in 1905 and 1906 the task was executed by Capt. Cambier, who has described the results of his mission before the Paris Geographical Society (*La Géographie*, December, 1906). He pointed out the advantages possessed by a route up the Ogowe valley, as compared with earlier suggested routes in the south of the territory, both as regards the facilities for the execution of the enterprise and the exploitation of the territory to the best advantage. The terminus should be on the Gabun, on account of the facilities offered to shipping by that river, and from the importance of linking Libreville with the interior. The line would strike the Ogowe at Njole, the point where it ceases to be navigable, and reaching the Ivindo by one of two alternative routes, strike across the water-parting to Makua, at the head of navigation on the Likuala. The result of the survey is to show that the scheme is quite practicable, though certain difficulties would be encountered, especially in the middle section. The best starting-point on the Gabun is Owendo, a little east of Libreville, and in order to reach Njole the line would turn the southern extremity of the Monts de Cristal. Above Njole, it would either hug the Ogowe on its northern bank, or make a circuit to the north up the valley of the Okano, afterwards striking across to the Ivindo. The crossing of the divide, at an elevation of 745 metres (2444 feet), would offer no special difficulties, nor, from an engineering standpoint, would the passage across the forest-clad plateau to the east. Captain Cambier calculates the total cost of the line at a little over £4,000,000, the total length being 830 kilometres, or 520 miles. One of the principal engineering works would be the bridge over the Ivindo, with a length of over 350 yards.

Proposed German Expedition across Africa.—It is announced from Berlin that the Duke of Mecklenburg-Schwerin will shortly undertake an expedition across Africa, to occupy two years.

AMERICA.

Surveys in the Yukon and Mackenzie Districts, North-West Canada.—It is naturally in these far-outlying districts that the most important geographical work is accomplished by the field parties of the Canadian Geological Survey. During 1905 some useful survey work was carried out in the little-known region between the basins of the Yukon and Mackenzie rivers. The summary report for that year, since received, includes an account of the work accomplished by Mr. Charles Camsell, the official in charge, the results being also shown by a large-scale map. The start was made from Dawson on May 22, and the Stewart river was ascended in canoes to its junction with the Beaver, the voyage being much impeded by the strength of the current, which brought with it large quantities of driftwood. To reach the basin of the Peel, Mr. Camsell chose a new route which led up Braine creek and across a pass 3300 feet above the sea to Nash creek, a tributary of the Wind river. Though an easy winter route, it proved not feasible for canoes, as it involved a portage of 15½ miles. The country between the two basins is rather rugged, with an average relief of about 3000 feet. The wide longitudinal valleys coincide with the strike of the rocks, and are joined by narrower and shorter transverse valleys. During the glacial epoch the ice filled the valleys only, to a depth of from 1000 to 1500 feet. The Wind river flows through the mountains in a broad U-shaped valley, timbered in parts with spruce and balsam poplar (none of the latter occurring on Braine creek). On leaving the mountains it emerges somewhat abruptly on a rolling country of foothills, replaced later by a level wooded plateau, which extends northwards practically to the Mackenzie delta. The Wind river joins the Peel near the lower end of a cañon, which is followed after 15 miles by a second, the walls of the latter being 500 feet

in vertical height, though navigation is not dangerous. During its passage across the plateau, the Peel cuts a deeper and deeper valley, till the banks attain a maximum height of 1000 feet. At an angle just south of 66° it receives from the south-east the Snake, once thought to be the main stream, but which proved to carry only about a fourth the volume of the south-western branch. At about 67° the Peel emerges from the plateau, which drops abruptly some 700 feet to what is probably the coastal plain. Below Fort Macpherson it enters the flood plain of the Mackenzie delta, in which nearly all the land is submerged during the spring floods. It soon divides into two channels, both of which sooner or later join the waters of the Mackenzie. A striking feature in the delta is the number of lakes which cover its surface everywhere. As far as 68° 30′ it is heavily wooded with spruce. The return route was by the Rat river, which enters the Peel from the west at the head of the delta, and down the Porcupine to the Yukon. Owing to the amount of rain and snow which had fallen, the water-level was raised, so that a portage of 600 yards only was necessary in crossing the divide.

Recent Crossing of Labrador.—Some additions to our knowledge of the geography of Labrador are furnished by its latest explorer, Mrs. L. Hubbard, jun., in the *Bulletin of the American Geographical Society* (vol. **38**, No. 9). Taking up her husband's exploratory mission in 1903, cut short by death, Mrs. L. Hubbard, in the two months, June 27 to August 27, 1905, traversed Labrador from Lake Melville to Ungava bay, and has gathered up the geographical results in the article referred to and its accompanying map of the Nascaupee and George rivers, which form a continuous water-line from Lake Melville to Ungava bay. A number of cuts illustrate particular features on the line of route. The map makes no claim to be other than the result of pioneer work. The instruments with which the traveller was equipped were a surveyor's compass, a sextant, and an artificial horizon dependant on water as the reflecting medium. Taking no observations for longitude, she obtained some for latitude as cartographic guiding-points. The controlling points of the journey had, however, been already determined. Mrs. Hubbard's map of the Nascaupee and George rivers differs considerably from maps issued in 1905. The Nascaupee from its source, a little below 55° N., to its mouth is, including windings, about 300 miles long, and it receives tributaries of considerable size. The George, rather longer, runs due north. The maximum temperature during the journey was 77° Fahr. in the shade; minimum under 30° Fahr.

An Ascent of Aconcagua has, we learn from *Globus* (vol. **91**, No. 3), been recently made by a Swiss alpinist named Heltling. On January 30, 1906, the traveller is said to have started with one companion from a camp at 4000 metres (13,000 feet), and spent the next night at an elevation of 19,500 feet, reaching the summit alone the next morning by almost the same route as was followed by Mr. Vines of the Fitzgerald Expedition. Herr Heltling is said to give the height of the mountain as 23,035 feet, though by what means it was determined is not stated.

AUSTRALASIA AND PACIFIC ISLANDS.

Measurement of Glacier Movements in New Zealand.—The recently issued report for 1905–6 of the New Zealand Survey branch of the Department of Lands contains an account by Mr. T. N. Brodrick of the results of the latest measurements carried out on the Mueller and Tasman glaciers on Mount Cook. Plans are given showing the comparative positions of the terminal face of the Tasman glacier in 1890 and 1906, and of the Mueller glacier in 1889, 1890, and 1906, a general advance being evident in both cases, although from the fact that the Hooker river flows along the face of the Mueller glacier, a retrograde movement might well have occurred. The positions of the numbered stones on this glacier in

various years are also shown, and a table compares the variation in the rate of movement in different seasons. It is shown that between 1895 and 1906 the ice was flowing about 1 inch a day slower than between 1889 and 1895, and the advance above mentioned is therefore surprising. The facts seem only to be accounted for by recent colder summers and lighter falls of snow in winter. The gradual compression of the ice in its course from the *névé* to the terminal face is well shown by the lessening distance between the marked stones as they advance downwards. Two stones which in 1889 were 5680 feet apart were only 3890 feet apart in 1906. This explains how the scattered medial moraines of the upper glacier gradually coalesce until they cover the whole lower surface. The rates recorded vary considerably, but nearly all lie between 2 and 8 inches *per diem*.

Austrian Exploration in New Guinea.—Dr. Rudolf Pöch, who as assistant physician to the Austrian Plague Expedition in 1897 and 1902, made a name for himself by his malaria researches in West Africa, has in 1904–6, with the aid of the Imperial Academy of Sciences in Vienna, prosecuted anthropological journeys in New Guinea, and has also with like purpose visited New South Wales, the Solomon Islands, and Bismarck archipelago. In these two years he has travelled along three-quarters of the coast of the island of New Guinea. At five spots he stopped for some length of time, and thence wandered into regions of the interior, still in part wholly unknown. The material brought home with him includes 300 measurements of living persons, 15 skeletons, 80 skulls, many anatomical preparations, 1500 photographs, more than 3000 feet of cinematograph films (taken by bioscopic camera), representing dances and scenes of village life. Included in the collection are also 90 plates for the phonographic archives of the Academy, with a view to the study of the language, songs, and music of the natives, and 2000 ethnological objects. Itineraries of the hitherto unknown regions were kept, and altitudes noted in them.

New Expeditions to New Guinea.—It is stated in the January number of *Petermanns Mitteilungen* that Dr. R. Schlechter, who is known for his investigations into the possibilities of rubber-planting in West Africa, will lead an expedition to German New Guinea, again under the auspices of the Kolonialwirtschaftliche Komitee, with the object of examining the rubber-resources of the territory and furthering the cultivation of rubber in the same. The starting-point on the coast will be Bongu on Constantine Haven, and the expedition will endeavour to follow the inner side of the Finisterre range, thence pushing on into the Ramu valley, and possibly extending its examination to the Bismarck range. A Dutch expedition into southern New Guinea, under Mr. H. Lorentz, has also, we learn from the same source, been decided on. It will choose, as a route into the interior, the Utumbuwe river, discovered in 1905. This has lately been visited by a Dutch war vessel, the river being ascended in a launch to 4° 52′ S., 138° 44′ E. The snowy range was still some 80 miles distant from that point, and the bearings taken seem to show that it lies further east than has been supposed.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Desiccation of Eurasia.—Prof. L. Berg, in an article contributed to the *Izvestiya* of the Russian Geographical Society (vol. **41**, No. 3), controverts the views of Prince Kropotkin on the desiccation of Eurasia (*Geo. Jour.* vol. **23**, pp. 722–734). He quotes from numerous authors to show that the climate of Asia and Egypt has been from time immemorial much the same as at present. Irrigation works were constructed by Khammurabi in Mesopotamia at the end of the twenty-third century B.C. The climate of Palestine seems not to have changed since Biblical times; the flora and the agricultural system of Egypt are the same as they

were 4000 years ago; and, according to Biot, the temperature of China is the same as it was 3300 years ago. From Quintus Curtius, Arrian, and the Arab geographers, it may be gathered that the same sandy wastes existed in their times, and that the Sea of Aral had about the same extension. The destruction of the cities in Central Asia Prof. Berg ascribes to the wars of Jenghis Khan, Timour, and other conquerors. All sand formations, he affirms, tend to become consolidated by vegetation, and it is only through injudicious rooting up of the vegetation that they are set in motion again. Such, at any rate, is his experience on the shores of the Sea of Aral and in Semirechiye. The Caspian and Aral seas undoubtedly occupied greater areas in the Post-Pliocene period than at present, and contracted on the retreat of the ice, leaving sands and clays containing shells behind them, which have often been mistaken for more recent deposits. Also, expeditions in Central Asia became particularly frequent in the sixties and seventies of last century, when high temperature and scarcity of rainfall prevailed, and hence, in Prof. Berg's opinion, sprang up the impression that the country was drying up. But the periods of unusual drought that have occurred have as little connection with the desiccation that took place in the Post-Pliocene period as the present increase of rainfall and rise in the lakes are indications of an approach of the former conditions. With regard to the extension of the Aral and Caspian seas shown in the sketch-map on p. 729 of the *Geographical Journal*, Prof. Berg states that he found Aral-Caspian deposits only in the immediate neighbourhood of the Aral, and he can affirm that Balkash never was connected with the Aral sea, and probably never stood more than 1 or 2 mètres above its present level.

Mud-cracks as a Criterion of Sedimentation.—A critical summary of what is known of the various forms of sedimentation, with special reference to mud-cracks, appears in the *Journal of Geology*, September–October, 1906, from the pen of Mr. Barrell, of Yale University. The bulk of present sedimentary deposits is formed either upon the land or beneath the sea. The littoral—that belt of shore exposed between the highest and lowest monthly tides—forms but a relatively narrow transitional zone. The chances of the preservation of littoral deposits are slight, for if the land is upraised they are the first to suffer erosion; while if the land sinks, the sea generally planes away the deposits left in front of it. Frontal portions of river deltas are the most favourable places for the preservation of broad littoral zones. Mud-cracks may, in the absence of fossils, be regarded as a distinguishing feature, by means of which it may be determined whether formations are fluviatile, lacustrine, estuarine, aëolian, or pertaining to the open shallow sea. In order that mud-cracks may be formed, the deposit should originate under very quiet waters, either removed by evaporation or slowly drained away with bottom velocities of less than one-third of a mile an hour. Factors governing the nature of the mud-cracks are the shrinkage nature of the deposit, its porosity, length of period of desiccation, temperature of the air. A mud-cracked loam does not easily preserve its detailed surface, except when remaining moist, so that little swelling takes place. A pure clay, slowly subsiding from quiet waters, and wet sufficiently long to become compact upon drying, would retain its mud-cracks upon rewetting either by rain or flood waters. Sandy wash filling the cracks of the previous clay layer would give a permanent record of the mud-cracks. An arid valley climate and abundant sediment are more favourable conditions for mud-crack development than an area covered with vegetation. The faintest markings are retained where the water slowly drains away. Cracks also form in the beds of "playas." Such lakes are always shallow and are always yellow with mud in suspension. When the water has disappeared, absolutely barren mud plains remain, which harden and crack in all directions. Numerous playa lakes are found in Nevada, in Australia, and in the African desert of

Kalahari. There is little likelihood of the incorporation of an organic record, either of leaves, bones, or tracks. Sand will tend to preserve the cracks into which it precipitates. Vegetation will eliminate them in many cases, and in basins of pre-Tertiary rocks they will not appear. On the margins of interior lakes wide expanses may become sun-cracked before a subsequent rise of water deposits another layer of clay. Lakes Titicaca and Tanganyika are examples. The exposed area is more subject to wave-action than are playa beds, and beaches are built, in which many organic remains are found. As in playas, sand preserves the cracks. On river flood plains the conditions of mud crack formation are at a maximum. Carbonaceous deposits occur in pluvial climates, and mud-cracks, as contrasted with coal-beds, may thus serve as an index to ancient climates. Formation of mud-cracks is non-essential on slopes of piedmont river waste, but is characteristic of the larger river plain and delta deposits of arid climates. The chances of ultimate preserval of the geologic record are comparatively great, as regards mud-cracks and organic remains. On the littoral zone, no cracks will remain on that portion which is wet twice a day. The more favourable places for development of mud-cracks are either those comprising extensive salt marshes, or regions of unusual tidal range. Where mud-cracks are occasionally formed beyond the tidal range by the inundations of the sea, they only attain a broad development in arid regions where continental river deposits have been previously built. Owing to these phenomena, mud-cracks of the littoral zone cannot be an important feature of geological formations. Remains of beach structures are found, and of such animals as frequent the shore. Next to coal-beds formed *in situ*, or land fossils, mud-cracks, on the whole, form one of the surest indications of the continental origin of argillaceous deposits. Mud-cracked shales predominantly indicate former flood-plain deposits, usually on delta surfaces which have displaced shallow seas. There is some degree of variance in modern text-books with this theory of mud-crack interpretation. Sir A. Geikie makes no mention of mud-cracks on flood-plains of rivers and apart from permanent bodies of standing water. Mud-cracked formations are found in the pre-Cambrian period region of Montana, also ripple-marks and the irregular surfaces of shallow-water deposits; long-enduring incursions of the sea are thus represented. In the Spokane and Grinnell argillites are seen traces of a wide deltaic fan. In the Grand Cañon series of Arizona ripple-marks and shrinkage cracks characterize the upper shaly beds. The mud-cracks of these pre-Cambrian deposits are confined to just such formations as from other characteristics suggest a flood-plain origin. These are usually separated from the limestone by transitional formations which differ in colour, in character, and in absence of mud-cracks, suggesting the true submarine deposits originating between the shore and the open sea.

The Source of the Water of Geysers.—In the November number of the *Geological Magazine*, Mr. J. M. Maclaren, of the Geological Survey of India, expresses a doubt as to the correctness of the views of Suess (*Geographical Journal*, vol. 20, p. 518) and others as to the necessarily deep-seated origin of geyser water, and, generally, of waters impregnated with mineral substances giving rise to metalliferous deposits. He points to recent geyser phenomena in New Zealand in support of his contention that such waters may be of quite superficial origin. The great Waimangu geyser, discovered in 1900, which remained in active eruption for over four years, sometimes sending up a mass of water 800 tons in weight to a height of 1500 feet, became dormant on October 31 and November 1, 1904, the very days on which the pent-up waters of the Tarawera lake overtopped their barrier, which two days later was completely carried away, so that the level is now 11 feet below its maximum. Instances are also quoted in which other New Zealand geysers have shown a dependence on superficial waters, and it is shown that the necessary heat to

create the motive force exists at no great depth. A case of recent metallic deposition from the waters of fumarolic areas is also quoted.

Connection between widely distant Earthquakes.—From the fact that, after an earthquake to which general attention has been called, shocks are frequently reported from widely separated localities, the public is apt to conclude that a connection exists between the several phenomena. The constancy with which minor shocks are occurring throughout all the areas liable to such disturbance renders this a somewhat hazardous conclusion, but an attempt has lately been made by the Rev. H. V. Gill to show by experiment that a seismic disturbance in one part of the globe is likely to be followed by others in widely separated regions. Having procured a hollow teetotum, made with great care, and a number of small steel balls, he found that whereas, on dropping a single ball into the spinning teetotum, an irregular motion was of course caused, an even spin was recovered when more balls were dropped in. In each case the balls, whatever the number, took up positions equally distant round the circumference. Mr. Gill, who has described the experiments in the *Scientific Proceedings of the Royal Dublin Society* (June, 1906), suggests that something like this happens in the case of disturbances in the Earth's crust, and the resulting displacement of matter. The effect of a single disturbance would be to produce a stress on other points round the Earth's circumference, the places of weakest crust being the first to yield. If the first to yield were not diametrically opposite the original seat of disturbance, the presence of the two disturbances would produce a displacement at some third point. In support of this theoretical conclusion, Mr. Gill points out that the sites of the three great disturbances of April, 1906 (Vesuvius, Formosa, San Francisco), are all situated on a narrow belt parallel to the equator; that the disturbances between them are comparable; and probably also the intensities of the disturbance.

CORRESPONDENCE.

Coffee Production in São Paulo, Brazil.

Palace of Agriculture, São Paulo, Brazil, January 14, 1907.

HAVING purchased for the library of the Department of Agriculture, Industry, and Commerce of the State Mr. J. G. Bartholomew's 'Atlas of the World's Commerce,' it appears to me and to others here that the "General Summary on Coffee," p. 85, and even the maps on p. 87, fail to emphasize the importance of our State as a coffee-producing region, and of Santos as a coffee port. Further, the remarks about the tree, its cultivation, and fruition are not applicable to our plantations. I therefore send you the following corrections from the Paulista point of view, and beg you to insert this letter in an early issue of the *Journal*.

The coffee-tree of São Paulo is by no means "a small shrub;" it commonly reaches 12 feet in height, and usually ladders are required to pick the berries. There are no German colonies in São Paulo cultivating coffee, but in 1901 there were 15,828 coffee estates, not counting the small holdings. Most of the planters are Paulistas. Many German labourers are employed in cultivating and picking coffee, but Italians predominate, and there are many Spaniards, Portuguese, and other Europeans. The planting of coffee is not suitable for colonists to undertake, as the trees only bear full crops at five years old. I do not know where "the coffee flowering season extends over eight months, and the berries are gathered three times a year," as stated, but in São Paulo the crop begins in April or May, and is continuous, extending over a period of 120 to 145 working days. Further, in

São Paulo the trees yield good crops long after their twentieth-year. We have trees yielding well planted fifty years ago. São Paulo is *the* coffee State, and Santos *the* coffee port of the world. We have already sent, in little over six months, 10,000,000 bags into Santos—say 600,000 tons—and the supply is still pouring in at a great rate, and will, it is thought, amount to 16,000,000 bags, or 960,000 tons, up to June 30 (the end of our agricultural years).

Small quantities of coffee are exported from Rio de Janeiro, from Victoria, in the State of Espirito Santo, and from Bahia, and a few bags from the northern ports.

On p. 88, at bottom, it is stated that the fall in price, June, 1901, is due to over-production. The Legislature of the State of São Paulo has recognized this to some extent by discouraging further planting for the present by taxing all new plantations; but the view taken in this State is that adulteration, favoured by enormous duties (136 frs. per 100 kilos in France) is the cause of the check to consumption. We have in our museum here a number of tins containing so-called "coffee mixtures," and an analysis made in London gives the quantity of coffee in the best sample as 70 per cent., whilst in the most there is only 13 per cent. of coffee.

The fact is, then, that the State of São Paulo alone produces about four-fifths of the world's supply of coffee, and practically all this is exported *viâ* Santo. Any commercial atlas or work dealing with coffee should emphasize these two cardinal points.

In conclusion, I beg to assure you that any information about this State wanted by writers or compilers of statistical works will be readily furnished on application to the Secretary for Agriculture, São Paulo, perhaps the only State in Brazil that can give any correct statistics.

FREDERIC H. SAWYER.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1906–1907.

Sixth Meeting, January 28, 1907. The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS.—*Bertram Victor Andrews; Rev. Daniel Cross Bates; George Beck; Bernard Robert Blakiston; Lieut.-Colonel S. G. Burrard, R.E.; Otio Stewart Chessman; Colonel Arthur Horsman, C.M.G., D.S.O.; Arthur Cotter; T. J. Eldridge; Lieut. E. J. English, R.N.R.; Arthur Faulkner; W. B. Gordon, C.I.E.; Z. Franklin Lieber; Nicholas Alfred Lionarons; Kenneth MacAndrew; Hans Gustav Myhoe; Prof. Francis Alfred Nixon; H. B. Ommanney; Samuel Herbert Pearse; Rev. Charles Cousens Petch; Geoffery Wm. Rhodes; John Rhodes; Captain Hugh W. Smith, D.S.O.; J. H. G. Tilbury; Lieut.-Colonel F. C. Trollope; Captain Sir George J. S. Warrender, Bart., R.N.*

The paper read was:—

"A Journey through Central Asia to Northern China." By Major C. D. Bruce.

RESEARCH DEPARTMENT.

February, 8, 1907.—Colonel Sir T. H. HOLDICH, K.C.M.G., K.C.I.E., C.B., R.E., in the Chair.

The papers read were:—

"Cutch and the Ran." By Robert Sivewright.

"Birth of a New Island in the Bay of Bengal." By Lieut. Headlam.

Seventh Meeting, February 11, 1907.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS.—*L. M. Calvocoressi; Emery Chubb; Lieut.-General Edward H. Clive; Robert Elliott Cooper; Wyndham Dunstan, M.A., LL.D., F.R.S.; Henry William Hipwell; Lewis Harry Goring Lloyd-Goring; Captain Dan Harrison Macdonell; Albert Ochs; Samuel P. Page; Malcolm Arnold Robertson; Charles Hope Shields; Eric Teichmann, B.A.; Oskar Teichmann, M.A.; Anthony Hamilton Vivian.*

The paper read was:—

"To the North Magnetic Pole, and through the North-West Passage." By Captain Roald Amundsen.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendes.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic—Tides. *M.k.u.k. Militärg. I.* **25** (1905): 49–76. ——

Die Beobachtungen am Flutmesser in Ragusa im Jahre 1905. *With Diagram.*

Alps—Simplon. *B.S.G. Italiana* **7** (1906): 753–773, 845–858. **Michieli.**

La Galleria del Sempione e i nuovi transiti internazionali. Comunicazione del Prof. A. Michieli.

Austria—Tyrol. *Beiträge Geophysik* **8** (1906): 79–112. **Greim.**

Studien aus dem Paznaun. II. Der Jamtalferner bis 1897. Von Dr. G. Greim. *With Map.*

Bulgaria. *Z. Ges. Erdk. Berlin* (1906): 405–425, 466–481. **Kassner.**

Bulgarien. Auf Grund eigener Reisen. Von Prof. Dr. C. Kassner. *With Illustrations.*

Denmark—Skagerak and Kattegat. **Petersen.**

Report of the Danish Biological Station to the Board of Agriculture, xiii.; 1903

and 1904. By Dr. C. G. Joh. Petersen. Copenhagen, 1906. Size 12 × 9, pp. 86. *Chart.*

English Channel. *Quest. Diplomatiques et Colon.* **10** (1906): 26–41. **Du Boulley.**

L'Archipel Anglo-Normand. La question des Ecrehous. Par P. Aubery du Boulley. *With Sketch-maps.*

The Ecrehous are rocky islets about 6 miles from the coast of Cotentin, which the writer thinks should be justly considered French.

Europe. **Fallex and Mairey.**

M. Fallex et A. Mairey. L'Europe (moins la France) au début du XX^e^ siècle. Paris: Librarie Ch. Delegrave, [1906]. Size 8 × 5, pp. 8 and 624. *Maps and Illustrations. Price 5 fr.* [To be reviewed.]

Europe. **Maxwell.**

A Cruise across Europe. Notes on a Freshwater Voyage from Holland to the Black Sea. By Donald Maxwell. London: John Lane, 1907 [1906]. Size 9 × 5½, pp. 256. *Sketch-maps and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

An attractively got-up book, giving entertaining sketches of travel across Europe by a little-used method.

Europe—Historical. **Helmolt and others.**

Weltgeschichte . . . herausgegeben von Hans F. Helmolt. Sechster Band. Mitteleuropa und Nordeuropa. Von Prof. Dr. Karl Weule, etc. Leipzig, etc.: Bibliographisches Institut, 1906. Size 10 × 7, pp. xviii. and 630. *Maps and Illustrations. Price* 10 *marks.*

France—Aude and Ariège. *B.S.G. Lille* **46** (1906): 176–191. **Farges.**

L'Aude et l'Ariège. I. Equisse géographique, historique, et ethnographique de la région. II. Voyage de Carcassonne à Saint-Girons par Axat, Saint-Paul-de-Fenouillet, Perpignan, Cols de la Perche et de Puymorens, Ax-les-Thermes et Foix. Par Louis Farges. *With Illustrations.*

France—Cartography. *Ann. G.* **15** (1906): 379–383. ——

La nouvelle carte de France au 50,000^e^. Publication des neuf premières feuilles.

France—Census. ——

République Française. Résultats statistiques du Recensement général de la population effectué le 24 Mars. 1901. Tome iii. Population présente. Régions de l'Ouest et du Midi. Paris: Imp. Nationale, 1906. Size 11 × 9, pp. xvi. and 890. *Presented by the Ministère du Commerce, etc.*

France—Central Plateau. *La G., B.S.G. Paris* **14** (1906): 61–78. **Buffault.**

Le plateau d'Aubrac. Par P. Buffault.

Noticed in the Monthly Record (January, p. 83).

France—Charente Inférieure. *B.S.G. Rochefort* **28** (1906): 100–109. ——

Notice sur la fabrication du sel marin dans les marais salants de la Charente-Inférieure.

France—Gascony. *B.S.G. Com. Bordeaux* **32** (1906): 245–252, 265–271. **Saint-Jours.**

Lège, le Porge, et les fables du littoral gascon. Par Capitaine Saint-Jours. *With Facsimile Map.*

France—Jura. *B.S.G. Lille* **46** (1906): 114–130. **Dumortier.**

Excursion dans le Jura. Par M. l'Abbé Dumortier. *With Illustrations.*

Germany—Hessen. **Hessler.**

Hessische Landes- und Volkskunde. Das ehemalige Kurhessen und das Hinterland am Ausgange des 19. Jahrhunderts. Im Verbindung mit dem Verein für Erdkunde zu Cassel und zahlreichen Mitarbeitern herausgegeben von Carl Hessler. Band I. Hessische Landeskunde. Zweite Hälfte. Marburg: N. G. Elwert, 1907. Size 9½ × 6½, pp. xii. and 870. *Map and Illustrations. Price* 10*s.* 9*d.*

Germany—Mecklenburg. **Geinitz.**

Die Einwirkung der Silvestersturmflut 1904 auf die mecklenburgische Küste. Von E. Geinitz. (Mitteilungen aus der Grossherzogl. Mecklenburg. Geologischen Landesanstalt, xvi.) Rostock, 1905. Size 11½ × 9, pp. 8. *Plates.*

Noticed in the Monthly Record (December, 1906, p. 630).

Italy—Sicily. **Sladen and Lorimer.**

Queer Things about Sicily. By Douglas Sladen and Norma Lorimer. London:

A. Treherne & Co., 1905. Size 8½ × 5½, pp. xxvi. and 422. *Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Turkey—Albania. **Steinmetz.**

Ein Vorstoss in die nordalbanischen Alpen. Von Karl Steinmetz. (Zur Kunde der Balkanhalbinsel: Reisen und Beobachtungen. Herausgegeben von Dr. Carl Patsch. Heft 3.) Wien und Leipzig: A. Hartleben, 1905. Size 9½ × 6½, pp. 64. *Map and Illustrations. Price 2s.*

United Kingdom. **Heaton.**

A Scientific Geography. Book II. The British Isles. By E. W. Heaton. London: Ralph, Holland & Co., 1906. Size 7½ × 5, pp. 138. *Maps. Price 1s. 6d. net. Presented by the Publishers.*

United Kingdom—Yorkshire. **Speight.**

Upper Nidderdale, with the Forest of Knaresborough. Being a Record of the History, Antiquities, Scenery, Old Homes, Families, etc., of that Romantic District. By Harry Speight. London: E. Stock, 1906. Size 7½ × 5, pp. 368 and lxxxvi *Map and Illustrations. Price 5s. net. Presented by the Author.*

A good example of the topographical descriptive works which have been so well represented in the literature of recent years. Though largely concerned with local history, it gives incidentally a good deal of information on the physical features of the district, of which the writer possesses an intimate knowledge.

ASIA.

Armenia. **Oswald.**

A Treatise on the Geology of Armenia. By Dr. Felix Oswald. Beeston, Notts.: published by the Author, 1906. Size 9 × 5½, pp. viii. and 516. *Maps, Illustrations, and Diagrams. Price 21s. net. Presented by the Author.* [To be reviewed.]

Central Asia—Tian Shan. **Keidel, Richarz, Kleinschmidt, and Limbrock.**

Abh. Math.-Phys. Kl., A. W. München **23** (1906): 89–232.

Aus den wissenschaftlichen Ergebnissen der Merzbacherschen Tian-Schan-Expedition. I. Geologische Uebersicht über den Bau des zentralen Tian-Schan, von H. Keidel. II. Die Gesteine des Profils durch das Bayum-Kol-Tal im nördlichen Teil des zentralen Tian-Schan, von Steph. Richarz. III. Die Gesteine des Profils durch das südliche Musart-Tal im zentralen Tian-Schan. Von A. Kleinschmidt und H. Limbrock. *With Map, Sections, and Illustrations. Also separate copies, presented by Dr. Gottfried Merzbacher.*

China—Hainan. *T'oung Pao.* **7** (1906): 369–380. **Feray.**

Les Japonais à Haï-Nan sous la dynastie des Ming (1368–1628). Par M. Feray. *With Map.*

China—Manchuria. *J. Tokyo G.S.* **18** (1906): 238–246. **Inouye and Ogawa.**

Geology and Mineral Resource of Southern Shengking Province. By Kinosuke Inouye and Takudzi Ogawa. *With Map.* [In Japanese.]

China—Orthography.

List of Names of Places in China, for which it has been decided to adopt the conventional spelling in War Office maps and publications, the correct spelling according to Wade's system being put in brackets, if considered necessary. [1906.] Size 13 × 8 (1 sheet).

Dutch East Indies. **Van der Lith, Snelleman, etc.**

Encyclopædie van Nederlandsch-Indie. Met Medwerking van verschillende Ambtenaren, Geleerden, en Officieren samengesteld door P. A. van der Lith, A. J. Spaan, en F. Fokkens. 4 vols. (Vol. 4, samengesteld door Joh. F. Snelleman.) The Hague, etc., M. Nijhoff [*not dated*, 1906]. Size 10½ × 7. *Price 125s.*

This important work will take its place as the standard work of reference on the Dutch East Indies. It treats exhaustively (under one alphabet) of places, persons, and subjects.

Eastern Asia—Earthquakes. *Beiträge Geophysik* **8** (1906): 113–218. **Rudolph.**

Ostasiatischer Erdbebenkatalog. Verzeichnis der im Jahre 1904 auf den Erdbebenstationen in Japan, Formosa, Manila und Batavia registrierten Störungen. Zusammengestellt von E. Rudolph. *With Map.*

French Indo-China. **Pavie.**

Mission Pavie Indo-Chine, 1879–1895. Géographie et Voyages. II. Exposé des Travaux de la Mission (Troisième et Quatrième périodes = 1889 à 1895). Par

Auguste Pavie. Paris: E. Leroux, 1906. Size 11 × 9, pp. 402. *Maps and Illustrations. Price* 10 *fr. Presented by the Author.*

French Indo-China—Annam. **Cadière.**

B. l'École Française d'Extrême-Orient **5** (1905): 349–367.

Les Hautes Vallées du Sông-Gianh. Par L. Cadière.

French Indo-China—Ethnology. *Tour du Monde* **12** (1906): 337–384. **Baudesson.**

Deux ans chez les Moïs. Par le Capitaine Baudesson. *With Map and Illustrations.*

French Indo-China—Ethnology. **Durand.**

B. l'École Française d'Extrême-Orient **5** (1905): 368–386.

Notes sur les Chams. Par E. M. Durand.

India. **Boeck.**

Dr. Kurt Boeck. Aus Indes et au Népal. Traduit par François Ricard. Paris: Hachette & Cie., 1907. Size 9½ × 6½, pp. viii. and 258. *Illustrations. Price* 15 *fr. Presented by the Publishers.*

The German original was briefly reviewed in vol. **21**, p. 66.

India. **Loti.**

India. By Pierre Loti. Translated from the French by George A. F. Inman; edited by Robert Harborough Sherard. London: T. Werner Laurie, (*not dated*). Size 9 × 5½, pp. 284. *Portrait. Price* 10*s.* 6*d. net. Presented by the Publisher.*

See review, *ante*, p. 216.

India. ——

Annual Report of the Board of Scientific Advice for India for the year 1904–05. Calcutta, 1906. Size 10 × 7, pp. iv., 138, and xii. *Chart.*

India—Irrigation. **Buckley.**

The Irrigation Works of India. By Robert Burton Buckley. Second Edition. London: E. & F. N. Spon, 1905. Size 13 × 10, pp. xx. and 336. *Maps, Illustrations, and Diagrams. Price* 42*s. net. Presented by the Publishers.*

Japan. **Cornish.**

Notes on Japanese Temples and Monasteries. By Dr. Vaughan Cornish. (Read before the Japan Society of London, December 4, 1904.) Size 10 × 6, pp. 18. *Illustrations. Presented by the Author.*

Korea. **Rossetti.**

Carlo Rossetti. Corea e Coreani: Impressioni e Ricerche sull' Impero del Gran Han. Two vols. Bergamo; Instutito Italiano d'Arti Grafiche, 1904–1905. Size 10½ × 7½, pp. (vol. 1) 170, (vol. 2) 232. *Maps, Plan, and Illustrations. Price* (*vol.* 1) *lire* 5; (*vol.* 2) *lire* 7. *Presented by the Author.*

AFRICA.

Abyssinia. *A travers le Monde* **12** (1906): 253. ——

L'Accord Anglo-franco-italien à propos de l'Abyssinie. *With Map.*

Africa—Communications. *Z. Kolonialpolitik* **8** (1906): 561–579. **Kürchhoff.**

Die Schiffahrt nach Afrika unter besonderer Berucksichtigung der deutschen Flagge. Von D. Kürchhoff.

Africa—Railways. **Jacob.**

Quest. Dipl. et Col. **10** (1906): 6–25, 91–109, 151–161, 216–230.

Les Chemins de fer Africains. Par Léon Jacob. *With Maps.*

Bechuanaland—Hydrology. **Du Toit.**

T. South African Philosoph. S. **16** (1906): 251–262.

Underground Water in South-Eastern Bechuanaland. By Alex. L. du Toit.

British East Africa—Ethnology. *P.R.S.* **18** (1906): 105–121. **Eliot.**

The Native Races of the British East Africa Protectorate. By Sir Charles Eliot.

Canary Islands. *Petermanns M.* **52** (1906): 145–153, 173–184. **Sapper.**

Beiträge zur Kenntnis von Palma und Lanzarote. Von Prof. Dr. Karl Sapper. *With Map.*

Cape Colony—Meteorology. *T. South African Philosoph. S.* **16** (1906): 217–236. **Sutton.**

The Climate of East London, Cape Colony. By J. R. Sutton.

Central Africa—Zoology. *P. Zoological S.* (1906): 534-535. **Halbert.**

Zoological Results of the Third Tanganyika Expedition, conducted by Dr. W. A. Cunnington, 1904-1905. Report on the *Hydrachnida*. By J. N. Halbert. *With Illustration.*

Congo State. *B.S.G. Italiana* 7 (1906): 864-878. **Cordella.**

Ricognizione nel Bacino dell' Elila (Stato indipendente del Congo) del Capitano E. Cordella. *With Map and Portrait.*

The Elila is the eastern tributary of the upper Congo, sometimes known as Lira. The journey was made by an Italian officer in the service of the State, who has since died of hæmaturic fever.

German South-West Africa—Hereros. **Irle.**

Die Herero. Ein Beitrag zur Landes-, Volks-, and Missionskunde. Von I. Irle. Gütersloh: C. Bertelsmann, 1906. Size 9 × 6, pp. viii. and 352. *Map and Illustrations. Price* 5*m. Presented by the Publisher.*

Madagascar. **Pappenheim.**

Madagascar: Studien, Schilderungen und Erlebnisse. Von Haupt Graf zu Pappenheim. Berlin: D. Reimer, 1906. Size 9½ × 6½, pp. xii. and 556. *Maps and Illustrations. Price* 8*m. Presented by the Publisher.* [To be reviewed.]

Rhodesia—Language. **Madan.**

Wisa Handbook: a short Introduction to the Wisa Dialect of North-East Rhodesia. By A. C. Madan. Oxford: Clarendon Press, 1906. Size 7 × 4½, pp. 136. *Price* 3*s. net. Presented by the Publishers.*

South Africa. **Cordier.**

Henri Cordier. Le Périple d'Afrique. Du Cap au Zambèse et à l'Océan Indien. Paris: E. Guilmoto, [*not dated*, 1906]. Size 9 × 5½, pp. 234. *Illustrations. Price* 7 *fr.* 50. *Presented by the Publisher.*

A record of the author's journey with the British Association.

Uganda. **Hattersley.**

Uganda by pen and camera. By C. W. Hattersley, with a preface by T. F. Victor Buxton. London: The Religious Tract Society, 1906. Size 8 × 5, pp. xviii. and 138. *Illustrations. Price* 2*s. Presented by the Publishers.*

West Africa. **Wallis.**

West African Warfare. By C. Braithwaite Wallis. London: Harrison & Sons [*not dated*, 1906]. Size 7½ × 5, pp. viii. and 118. *Presented by the Author.*

Useful practical hints to officers likely to be engaged in military operations on the West Coast, partly taken from the author's book, 'The Advance of our West African Empire' (*Journal*, vol. 22, p. 691).

NORTH AMERICA.

Canada. *Hist. and Sc. S. Manitoba*, No. 71 (1906): pp. 12. **Sherbinin.**

The Galicians dwelling in Canada and their Origin. By Michael A. Sherbinin.

Canada—British Columbia. **Boas and Hunt.**

Kwakiutl Texts, Second Series. By F. Boas and G. Hunt. (The Jesup North Pacific Expedition. Memoir of the American Museum of Natural History, vol. 10, part 1.) Leiden: E. J. Brill; New York: G. E. Stechert & Co., 1906. Size 14 × 11½, pp. 270.

Canada—British Columbia. **Teit.**

The Lillooet Indians. By J. Teit. (The Jesup North Pacific Expedition. Memoir of the American Museum of Natural History, vol. 2, part 5.) Leiden: E. J. Brill; New York: G. E. Stechert & Co., 1906. Size 14 × 11½, pp. 193-300. *Illustrations.*

Canada—Manitoba. *Hist. and Sc. S. Manitoba*, No. 69 (1906): pp. 8. **Turner.**

The Moose and Wapiti of Manitoba. A Plea for their Preservation. By J. P. Turner. *With Illustrations.*

Canada—Northern Waters. **Low.**

Report on the Dominion Government Expedition to Hudson Bay and the Arctic Islands on board the D.G.E. *Neptune*, 1903-1904. By A. P. Low. Ottawa: Government Printing Bureau, 1906. Size 9 × 6, pp. xvi. and 356. *Map and Illustrations. Presented by the Author.*

See summary of the events of the voyage in the *Journal* for September, 1905 (p. 318).

Canada—Quebec. **Low.**

Geological Survey of Canada. Report on the Chibougaman Mining Region in the Northern part of the Province of Quebec. By A. P. Low. 1905. Ottawa, 1906. Size 10 × 6½, pp. 62. *Map.*

Noticed in the Monthly Record (vol. **28**, p. 639).

Mexico. *B.G.S. Philadelphia* **4** (1906): No. 5, 1–24. **Hovey.**

Notes on Northern Mexico: Its Deserts, Plateaus, and Canyons. By Edmund Otis Hovey. *With Illustrations.*

Account of observations made during the journey referred to in vol. **26**, p. 218; vol. **27**, p. 90.

CENTRAL AND SOUTH AMERICA.

Bolivia and Peru—Boundary. **Saavedra.**

Defensa de los Derechos de Bolivia ante el Gobierno Argentino en el Litigio de Fronteras con la Republica del Peru. Por Bautista Saavedra. 2 vols. Buenos Aires, 1906. Size 8½ × 6, pp. (vol. 1) 318; (vol. 2) 294. *Maps. Presented by the Ministro de Colonias y Agricultura, Bolivia.*

Bolivia and Peru—Boundary. ———

Allegato de parte del Gobierno de Bolivia en el Juicio Arbitral de Fronteras con la República del Peru. (Pp. xviii. and 320.) Colección de Documentos que apoyan el Allegato de Bolivia en el Juicio Arbitral con la República del Peru. 2 vols. Pp. (vol. 1), 546; (vol. 2), 598. *Maps. Presented by the Ministro de Colonias y Agricultura, Bolivia.*

Brazil. *J. Geology* **14** (1906): 374–401. **Derby.**

The Serra do Espinhaço, Brazil. By Orville A. Derby. *With Sketch-maps and Illustrations.*

Central America—Treaty. ———

Treaty Series: No. 11, 1906. Treaty between the United Kingdom and the Republic of Nicaragua with regard to the Mosquito Territory. Signed at Managua, April 19, 1905. London, 1906. Size 9½ × 6, pp. 6. *Price* ½*d.*

Falkland Islands—Palæobotany. **Nathorst.**

Phyllotheca-Reste aus den Falkland-Inseln. Von A. G. Nathorst. (Reprinted from *Bull.* of the Geol. Instit. of Upsala, vol. 7.) Upsala, 1906. Size 9½ × 6½, pp. 72–76. *Plate.*

Noticed in the Monthly Record.

Panama. *Deutsch. Rundschau G.* **28** (1906): 433–442. **Fischer.**

Der Isthmus von Panama. Beobachtungen und Daten von einer Studienreise nach Panama. Von E. S. Fischer. *With Illustrations.*

West Indies—Dominica. **Grieve.**

Notes upon the Island of Dominica (British West Indies). Containing Information for Settlers, Investors, Tourists, Naturalists, and Others; with Statistics from the Official Returns, also Regulations regarding Crown Lands and Import and Export Duties. By Symington Grieve. London: A. & C. Black, 1906. Size 7½ × 5, pp. 126. *Map and Illustrations. Price* 2*s.* 6*d. net. Presented by the Publishers.*

AUSTRALASIA AND PACIFIC ISLANDS.

Caroline Islands—Yap. *Z. Kolonialpolitik, etc.* **8** (1906): 197–283, 375–432. ———

Die Karolineninsel Jap. *With Map, Sections, and Illustrations.*

See note in the February number (p. 231).

New Guinea. *Z. Ges. Erdk. Berlin* (1906): 490–492. **Pöch.**

Bemerkungen ueber die Eingeborenen von Ost- und Süd- Neu-Guinea. Briefliche Mitteilung von Dr. R. Pöch.

New Guinea—German. *Sitzb. K.A.W. Wien* **114** (Ab. I.) (1905): 437–453, 689–698. **Pöch.**

Erster Bericht von meiner Reise nach Neu-Guinea über die Zeit vom 6. Juni 1904 bis zum 25. März 1905. Ditto, Zweiter Bericht . . . vom 28 März 1905 bis zum 21 Juni (Bismarck-Archipel, 20 März bis 14 Juni) 1905. Von Dr. R. Pöch.

The journey was undertaken chiefly for anthropological research (see *ante*, p. 350).

New South Wales—Minerals. **Andrews.**

Molybdenum. By E. C. Andrews. (New South Wales. Geological Survey, Mineral Resources, No. 11.) Sydney, 1906. Size 9½ × 6½, pp. 18. *Illustrations.*

The sulphide of molybdenum, known as molybdenite, is used in hardening steel.

New Zealand. *Quarterly J. Geol. S.* **62** (1906): 381–424. **Marshall.**

The Geology of Dunedin (New Zealand). By Dr. Patrick Marshall. *Map and Plates.*

Pacific Islands. **Krämer.**

Hawaii, Ostmikronesien, und Samoa. Meine zweite Südseereise (1897–1899) zum Studien der Atolle und ihrer Bewohner. Von Prof. Dr. Augustin Krämer. Stuttgart: Strecker & Schröder, 1906. Size 9½ × 7, pp. xvi. and 586. *Sketch-map and Illustrations. Price* 10*m. Presented by the Publishers.* [To be reviewed.]

POLAR REGIONS.

Antarctic—British Expedition. **[Scott and Others.]**

The Logs of the S.S. *Discovery.* 4 vols. [Deck Log Book: vol. **1**, August 6, 1901, to February 9, 1902. The same: vol. **2**, February 16, 1904, to September 10, 1904. Official Log Book: vol. **1**, August 6, 1901, to November 28, 1901. The same: vol. **2**, December 24, 1901, to February 8, 1902, and February 16, 1904, to April 1, 1904.] Size 17 × 10½ (MS.). *Presented by the National Antarctic Expedition.*

Antarctic—French Expedition. **Charcot.**

Journal de l'Expedition Antarctique Française, 1903–1905. Le "Française au Pôle Sud." Par J.-B. Charcot. Préface par l'Amiral Fournier. Paris: E. Flammarion, [1906]. Size 11 × 7½, pp. xxxviii and 486. *Map and Illustrations. Price* 15 *fr. Presented by the Author.* [To be reviewed.]

Antarctic—Scottish Expedition. **Bruce.**

Report on the Work of the Scottish National Antarctic Expedition. By W. S. Bruce. (Read at the Meeting of the British Association, Section E, Cambridge, 1904.) Edinburgh, *not dated* [1906?]. Size 10 × 6, pp. 10. *Map and Illustrations. Presented by the Author.*

Arctic—Swedish Expedition. **Hamberg.**

K. Svensk. Vet.-A. Handl. **39**, No. **6** (1905): pp. 62.

Astronomische, photogrammatische und erdmagnetische Arbeiten der von A. G. Nathorst geleiteten Schwedischen Polarexpedition 1898. Von A. Hamberg. *With Map and Illustrations.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology. *Beiträge Geophysik* **8** (1906): 43–59. **Arldt.**

Parallelismus auf der Erdoberfläche. Von Dr. T. Arldt.

Papers by the same writer dealing with parallelism in special regions have been already noticed in the *Journal* (**18**, 536; **28**, 511).

Geomorphology—Deserts. **Wiszwianski.**

Die Faktoren der Wüstenbildnung. Von Dr. Helene Wiszwianski. (Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin; herausgegeben von Ferdinand Frhr. v. Richthofen. Heft 9.) Berlin: E. S. Mittler und Sohn, 1906. Size 10 × 7, pp. 90. *Diagrams. Price* 3.75*m. Presented by the Publishers.*

Geophysics. *Petermanns M.* **52** (1906): 190–191. **Hammer.**

Die isostatische Lagerung der äusseren Erdschichten. Von Prof. Dr. E. Hammer.

Geophysics. *Quarterly J. Geol. S.* **62** (1906): 456–475. **Oldham.**

The Constitution of the Interior of the Earth, as revealed by Earthquakes. By R. D. Oldham. *With Diagrams. Also separate copy, presented by the Author.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *G.Z.* **12** (1906): 378–401, 449–463. **Chalikiopoulos.**

Anpassungsbedingungen und Entwickelungsmotive der Kultur. Von L. Chalikiopoulos.

An elaborate dissertation on the various types of culture and their conditions of development.

Anthropogeography. *J. of G.* **5** (1906): 120–126. **Sutherland.**

Geography and Life. By W. J. Sutherland.

Historical—Dutch Voyages. **Spilbergen, Le Maire, and Villiers.**

The East and West Indian Mirror, being an account of Joris van Spielbergen's

Voyage round the World (1614–1617), and the Australian Navigations of Jacob le Maire. Translated, with Notes and an Introduction, by J. A. J. de Villiers. (Hakluyt Society's Publications, Second Series, No. xviii.) London, 1906. Size 9 × 5¾, pp. lxii. and 272. *Facsimile Maps and Illustrations. Presented by the Hakluyt Society.*

This is the first complete English translation of Spilbergen's famous voyage. All the original illustrations are reproduced.

Historical—Voyages. **Purchas.**

Hakluytus Posthumus or Purchas His Pilgrimes. Contayning a History of the World in Sea Voyages and Lande Travells by Englishmen and others. By Samuel Purchas. Vols. 17, 18, and 19. Glasgow: J. MacLehose & Sons, 1906. Size 9 × 6, pp. (vol. 17) xviii. and 550; (vol. 18) xx. and 540; (vol. 19) xxiv. and 550. *Maps and Illustrations. Price* 12*s.* 6*d. net per vol. Presented by the Publishers.*

These volumes embrace the latter part of the American voyages, contained in Books 7–10 of the Second Part of the Edition of 1625.

GENERAL.

British Empire. **Herbertson.**

Descriptive Geographies from Original Sources. The British Empire. Selected and edited by F. D. Herbertson. London: A. & C. Black, 1906. Size 7 × 4½, pp. xiv. and 254. *Illustrations. Price* 2*s.* 6*d. Presented by the Publisher.*

This is a useful addition to the series of descriptive geographies by the same author. It consists chiefly of extracts from the former volumes, with some additions.

Travels. **Lithgow.**

The Totall Discourse of The Rare Adventures and Painefull Peregrinations of long Nineteene Yeares Travayles from Scotland to the most famous Kingdomes in Europe, Asia, and Affrica. By William Lithgow. Glasgow: James MacLehose & Sons, 1906. Size 9 × 6, pp. xxxii. and 450. *Facsimile Plates. Price* 12*s* 6*d. net. Presented by the Publishers.*

Reprint of the first edition of 1632.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria-Hungary. **Artaria.**

Artaria's Eisenbahn- und Postkarte von Oesterreich. Vierte Neubearbeitung. 7 Auflage. Scale 1:1,500,000 or 1 inch to 23·7 stat. miles. Vienna: Artaria & Co., 1907. *Price* 2.20*k. Presented by the Publisher.*

Austria-Hungary. **Oberhummer and Wieser.**

Wolfgang Lazius Karten der österreichischen Lande und des Königreichs Ungarn aus den Jahren 1545–1563. Im Auftrage der K. K. Geographischen Gesellschaft in Wien zur Feier ihres fünfzigjährigen Bestandes. Herausgegeben mit Unterstützung des K. K. Ministeriums für Kultus und Unterricht von Eugen Oberhummer und Franz R. von Wieser. Innsbruck Wagner'schen Universitäts-Buchhandlung, 1906.

This portfolio of facsimile maps will be specially noticed.

Central Europe. **K. u. K. Militärgeographisches Institut.**

Neue Uebersichts-Karte von Mittel-Europa. Scale 1:750,000 or 1 inch to 8·7 stat. miles. Sheet J8, Adrianopel. Vienna: K. u. K. Militärgeographisches Institut, [1906].

Central Europe. **Liebenow and Ravenstein.**

Liebenow-Ravenstein's Special-Radfahrerkarte von Mittel-Europe. Scale 1:300,000 or 1 inch to 4·7 stat. miles. Sheets: 79, Kielce; 93, Miechow; 94, Rzeszów; 134, Schemnitz; 135, Rima-Szombat; 148, Komorn; 149, Jász-Berény; 159, Murau; 162, Stuhleveissenburg. Frankfurt-a-Main: Ludwig Ravenstein, [1906].

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1907.

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Germany. **Hantzsch.**

Die ältesten gedrückten Karten der sächsisch-thüringischen Länder (1550–1593). Herausgegeben und erläutert von Viktor Hantzsch. Leipzig: B. G. Teubner, 1905.

These facsimile maps will be specially noticed.

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilung der Königlichen Preussische Landesaufnahme. Scale 1: 100,000 or 1 inch to 1·6 stat. mile. Sheet 342, Luckau. Berlin: K. Preussische Landesaufnahme, 1906. *Price* 1.50*m. each sheet.*

London. **Railway Clearing House.**

Official railway map of London and its environs. Scale 1:31,680 or 2 inches to 1 stat. mile. 2 Sheets. Prepared and published at the Railway Clearing House, London, 1907. *Price* 8*s.* 6*d.*

London. **Stanford.**

A new map of Metropolitan Railways, Tramways, and Miscellaneous Improvements deposited at the London County Council, November 30, 1906, for Session 1907. Scale 1 : 63,360 or 1 inch to 1 stat. mile. London: Edward Stanford, 1907. *Price* 1*s.* 6*d.*

ASIA.

Chih-li. **Topographical Section, General Staff.**

Province of Chih-li (southern sheet). Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1906. *Price* 2*s.* *Presented by the Director of Military Operations.*

AFRICA.

Abyssinia. **Rossetti.**

Schizzo dimostrativo delle principali concessioni per ricerche minerarie accordate dall' Imperatore Menelik II. in Etiopia da Carlo Rossetti. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Rome: G. De Agostini & Co., [1906]. *Presented by the Author.*

A useful little map of Abyssinia showing approximately the limits of the various mining concessions granted to European syndicates.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets (Sierra Leone): 58-L, P, 59-I, M, 70-D, 71-A; (Uganda) 86-A, E, I, M, N. London: Topographical Section, General Staff, War Office, 1906. *Price* 1*s.* 6*d. each sheet.* *Presented by the Director of Military Operations.*

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Bahr el Ghazal. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Compiled in the Topographical Section, General Staff. London: Topographical Section, General Staff, War Office, 1906. *Price* 2*s.* *Presented by the Director of Military Operations.*

Egypt. **Egyptian Survey Department.**

Map of Egypt. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: N.W. I.-I. S.E. I.-I., I.-II., II.-I., II.-II., III.-I., III.-II., XXIV.-VI. and VII. Giza: Survey Department. *Presented by the Director-General, Survey Department, Giza.*

North-East Africa. **Rossetti.**

Schizzo dimostrativo della situazione politica nell' Affrica Orientale da Carlo Rossetti. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Rome: G. De Agostini & Co., 1906. *Presented by the Author.*

A small outline map of North-East Africa, showing in colours possessions of European countries and regions under the various Ethiopian chiefs.

South Africa. **"South Africa."**

The Railway map of South Africa. Scale 1 : 3,928,320 or 1 inch to 62 stat. miles. Revised to date and published by authority at the offices of "South Africa," Winchester House, London, 1907.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheet: Environs of Gafsa. Paris: Service Géographique de l'Armée, [1906]. *Price* 1.50 *fr.*

AMERICA AND WEST INDIES.

Alaska. **Habenicht and Böhmer.**

Karte von Alaska, hauptsachlich nach der "Map of Alaska," compiled by E C. Barnard, U.S. Geological Survey, mit Benutzung neuen materials unter Leitung von H. Habenicht bearbeitet von C. Böhmer. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 1. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet 69, Moosejaw, revised to November 27, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Department of the Interior, Ottawa.*

Chile. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet: Magallanes. Santiago: Oficina de Limites, [1906]. *Presented by the Director, Oficina de Limites, Santiago.*

Haiti. **De Moya.**

Mapa de la Isla de Santo Domingo y Haiti por el General Casimiro N. de Moya. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Santo Domingo City: R. Piñeyro & Co.; Hamburg: L. Friederichsen & Co., 1905. *Price* 45*m.* *Presented by Messrs. L. Friederichsen & Co.*

With the exception of the charts of the coast, very little reliable cartographical material exists for constructing a map of the island of San Domingo and Haiti on a large scale. Still, such as is available seems, on the whole, to have been made use of in the above map, and the author acknowledges in a note the sources from which he has taken his information, specially referring to the British and American Admiralty charts and those published by Messrs. James Imray & Co., of London. It is, however, noticeable that in the neighbourhood of the Bay of Neiba the configuration of the country differs considerably from the map of the same district by Mr. J. Wells, given in vol. 3 of the R.G.S. Supplementary Papers. The map is a somewhat roughly coloured production, but contains a good deal of general information as to roads, railways, relative importance of towns and villages, etc. Plans of Port au Prince and San Domingo city are given as insets, together with tables of distances.

United States. **U.S. Geological Survey.**

Geological Atlas of the United States. Folios: 136, St. Mary's, Maryland-Virginia; 137, Dover, Delaware—Maryland—New Jersey; 138, Reading, California; 139, Snoqualmie—Washington; 140, Milwaukee, Wisconsin. Washington: Department of the Interior, U.S. Geological Survey, 1906. *Presented by the United States Geological Survey.*

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Parts 18 and 19. London: George Newnes, Limited, [1907]. *Price* 6*d. each part.* *Presented by the Publisher.*

The following are the contents of these two parts of this atlas:—Part 18, Plates: 97, Fruit supply; 98, 99, Apples, bananas, oranges, dates, etc.; 100, Fruit statistics; 157, Timber and cabinet woods, cork, etc.; 158, 159, Timber-growing countries; 160, Timber and cabinet woods. Statistics. Part 19, Plates: 101, Dairy produce; 102, 103, Dairy produce, exported and imported; 104, Domestic animals; 137, Marble, phosphates, etc.; 138, 139, Tin, platinum, aluminium; 140, Mercury, zinc, etc. In addition to the maps and diagrams, each of these parts contains a continuation of the 'Commercial Gazetteer of Countries and Ports.'

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams and 105,000 references. Parts 6, 7, and 8. London: The Amalgamated Press, Limited, 1906. *Price* 7*d. each part.*

These parts contain the following maps:—Part 6, Sheets: 1-2, Physical World in Hemispheres; 125-126, The Far East (Industries and Communications). Part 7, Sheets: 39-40, The North of Ireland; 153-154, North America (general map). Part 8, Sheets: 27-28, The West of England and Wales; 101-102, Indian Ocean (Cable and Ocean Depths); 135-136, Africa (Industries and Communications).

World. **L'Estrange.**

Philip's Progressive Atlas of Comparative Geography. Edited by P. H. L'Estrange, B.A. London: George Philip & Son, Ltd., [1907]. *Price* 3*s.* 6*d. net.* *Presented by the Publisher.*

This atlas is composed of the coloured maps in the 'Progressive Course of Comparative Geography' by the same author, which are arranged here as in that work.

The surface characteristics and structure of countries, seasonal temperature and pressures, wind and rainfall, vegetation, minerals, communications, distribution of population and political divisions are all dealt with, whilst the positions of cities and towns, ports, trade routes, etc., are shown on separate maps, with a test map printed on the back of each, marked with symbols instead of names.

World. **Putzger.**

F. W. Putzgers historischer Schul-Atlas zur alten, mittleren und neuen Geschichte. Bearbeitet und herausgegeben von Alfred Baldamus und Ernst Schwabe. Dreiszigste Auflage. Bielefeld and Leipzig; Velhagen & Klasing, 1906.

This is the thirtieth edition of this well-known little school historical atlas which has deservedly obtained a good reputation, and is in considerable demand on the continent. It now consists altogether of 238 coloured maps and inset plans, prefaced by brief explanatory text. These are all well arranged and carefully prepared. Considering the small cost, the total amount of information given in the atlas is surprising.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas verkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 35, 36, 37, and 38. Gotha: Justus Perthes, 1906. *Price 60 pf. each part.*

These parts contain the following maps:—Part 35–36, Sheets: 39, Ireland; 52, Balkan peninsula, sheet 2; 56, North and Central Asia; 76, Australia and Polynesia. Parts 37–38, Sheets: 34, Spain and Portugal, sheet 3; 49, Russia, sheet 6; 68, Africa, general map.

There is very little change in these sheets, and, with slight modifications to boundaries, they are as they appeared in the last issue. The map of North and Central Asia would have been improved for a further correction, especially the Tibet section. However, it is only a small-scale general map, and too much must not be expected.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during December, 1906. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
34 m	= 3·0	England, south coast:—The Scilly isles. 3*s.*
3601 m	= 4·6	Scotland, west coast:—Loch Dunvegan, including Loch bay. 3*s.*
2582 m	= 5·3	Orkney islands:—Pierowall road and approaches. 3*s.*
3578 m	= 0·6	Spain, south coast:—Eastern approaches to the strait of Gibraltar. 3*s.*
337 m	= 6·0	Canada, Lake Ontario:—Toronto harbour. 2*s.*
1313 m	= 0·5	Chile. The channels between Maullin bay and Port Montt. Plans:—River Maullin, Port Abtao, Port Montt. 3*s.*
3594 m	= 2·9 6·0	British Columbia. Plans on the east coast of Vancouver island:—Ganges harbour and Captain passage. Porlier pass. 2*s.*
69 m	= 7·2	Ceylon:—Pámbam pass. 3*s.*
3615 m	= 3·6 7·2 7·3	Plans in the Philippine islands:—Santa Cruz harbour, Port Banalakan, Port Boca Engano. 2*s.*
945 m	= 2·7	Philippine islands:—Ports Masinlok and Matalvi and Palauig bay. 2*s.*
3588 m	= 0·77	China:—Canton river delta. 3*s.*
1255 m	= 0·18	China, north coast:—Kyau chau bay to Lai chau bay. 3*s.*
913 m	= 0·3 5·5	Korea, west coast:—Mackau group to Clifford islands. Plan:—Ochon To anchorage (Palos harbour). 3*s.*
3114 m	= 7·9	Japan:—Moji and Simonoseki ko. 2*s.*
3566 m	= 0·5 4·4 11·8 2·0	Japan:—Izumi Nada and Harima Nada. Plans:—Yura ko, Sumoto ko, Kata Seto. 3*s.*

New Plans and Plans added.

No.	Inches.	
633 m	= 6·9	Harbours and anchorages on the east coast of Ireland. New plan :—Malahide inlet. 2*s*.
2063 m	= 10·0	Malta island, northern portion. Plan added :—Ras in Nieshfa bay. 4*s*.
708 m	= {0·5 / 1·8}	Anchorages on the west coast of Madagascar. New plans :—Nosi Mitsio (Minow islands), Ampasimena (Diamond) bay. 2*s*.
944 m	= 1·4	Ports in the Philippine islands. New plan :—Port Batan. 2*s*.
991 m	= 3·5	Anchorages on the coast of Yezo island. New plan :—Kushiro road. 2*s*.
3409 m	= 3·3	Japan :—Ishinomaki wan (Sendai bay) and Sakata ko to Tsugaru Kaikyo. Plan added :—Obato wan. 3*s*.
210 m	= 2·6	Japan :—Harbours on the east coast of Nipon. New plan :—Yamada ko. 2*s*.
1648 m	= 0·19	Japan :—Osumi Kaikyo (Van Diemen strait) to O shima. Plan added :—Osumi group. 3*s*.
3340 m	= 1·98	Gulf of Tartary, northern sheet. Plan added :—Sertuna river anchorage. 3*s*.
845 m	= 10·0	Fiji :—Kandavu passage to Kowata island. Plan added :—Likuri island anchorage. 4*s*.
1386 m	= 3·6	Islands in the south Pacific ocean. New Plan :—Cook bay or Hanga roa. 2*s*.

Charts Cancelled.

No.		Cancelled by	No.
34	England, south coast :—The Scilly isles.	New chart. The Scilly isles	34
1202	Scotland, west coast :—Loch Dunvegan on this sheet.	New plan. Loch Dunvegan, including Loch bay	3601
2582	Orkney islands :—Pierowall road.	New chart. Pierowall road and approaches	2582
337	Canada : Lake Ontario :—Toronto harbour.	New plan. Toronto harbour	337
1313	Chile : the channel between Port de Ancud and Port Montt. Plans :—River Maullin, Port Abtao, Port Montt.	New chart. The channels between Maullin bay and Port Montt. Plans :—River Maullin, Port Abtao, Port Montt	1313
3029	British Columbia : Active pass to Gabriola pass and inner channels :—Plan of Porlier pass on this sheet.	New plan. Porlier pass on chart	3594
69	Ceylon :—Pámbam pass.	New plan. Pambam pass	69
945	Philippine islands :—Ports Masinglok and Matalvi.	New plan Ports Masinlok and Matalvi and Palauig bay	945
1255	China, north coast :—Kyau chau bay to Miau tau strait.	New chart. Kyau chau bay to Lai chau bay	1255
913	Western coast of the Korea :—Mackau group to Clifford islands. Plan :—Palos harbour.	New chart. West coast of Korea :—Mackau group to Clifford islands. Plan :—Ochon To anchorage (Palos harbour)	913
3114	Japan :—Anchorages in Simonoseki strait :—Moji ko.	New plan. Moji and Simonoseki ko	3114
357	Japan : Harbours in the Kii channel :—Plan of Yura harbour on this sheet.	Plan of Yura ko on new chart	3566

Charts that have received Important Corrections.

No. 1967, England, south coast :—Plymouth sound. 2978, Iceland :—Sigle fiord to Niardvig. 2172, Alaska :—Bering strait. 2908, Africa, south coast :—Port Natal entrance. 2062, Cochin China :—Tong king gulf. 3349, China :—Approach to Kwang chau wan. 1655, Korea :—Southern approach to Ping Yang inlet.

(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat. and Red Sea for February, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for February, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Publisher.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for January, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for February, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

British East Africa. **Murray.**

Fourteen photographs of British East Africa, taken by Captain E. M. Murray. *Presented by Captain E. M. Murray.*

(1–3) Kavirondo at Karungu; (4 and 5) Kavirondo women waiting to be paid at Karungu; (6) Kavirondo women, Karungu; (7) Masai women, Southern Guaso Nyiro; (8) Interior of a Masai village, Southern Guaso Nyiro; (9) Southern Guaso Nyiro, Masai women at the ford; (10) The Southern Guaso Nyiro near the German boundary; (11) Baggage crossing Southern Guaso Nyiro by rope; (12) Bridge building over the Mara river; (13) Kopje on the German boundary; (14) Cactus tree on the German boundary.

Clapperton Memorial. **Burdow.**

Photograph of tablet erected in Sokoto by Major J. A. Burdon, the first resident of the Sokoto province, to the memory of Commander Hugh Clapperton, R.N., bearing the following inscription: "In memory of Hugh Clapperton, Commander R.N., the first European to visit Sokoto, March 16, 1824. He died there April 13, 1827, and was buried at Jungevi." *Presented by Major J. A. Burdon.*

Færöe Islands. **Hepburn.**

Thirty photographs of the Færöe islands, taken by the late David Hepburn, Esq. *Presented by David Hepburn, Esq.*

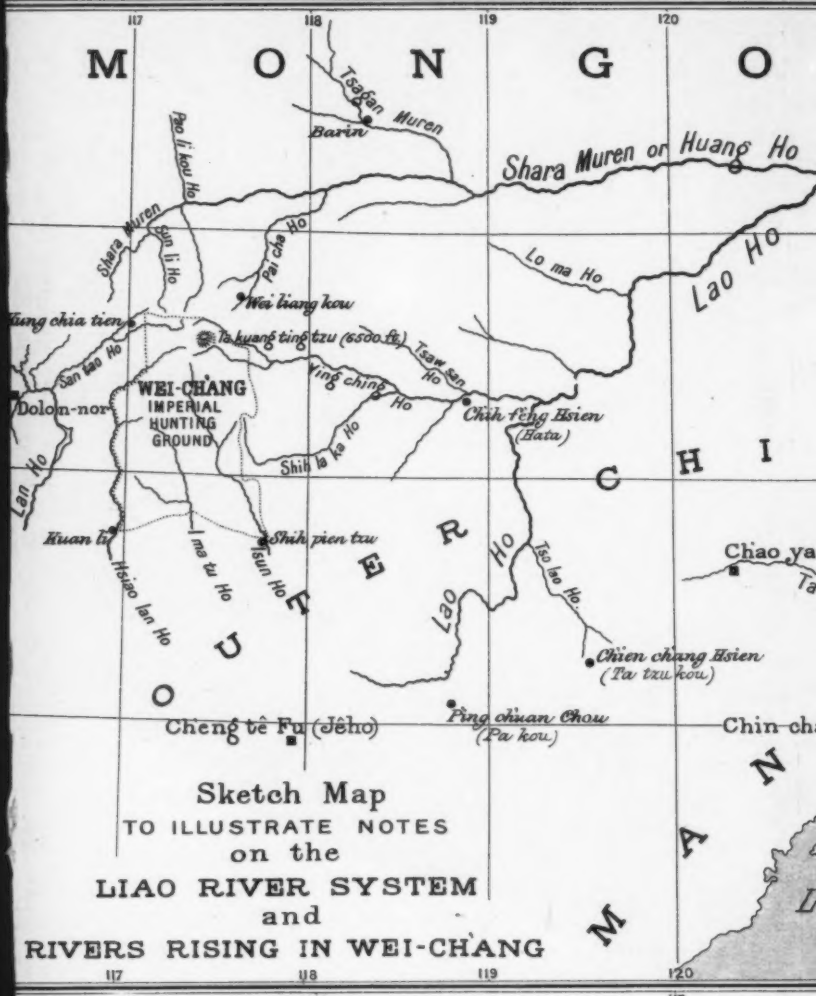
The Society has already been indebted to Mr. Hepburn (whose comparatively early death is to be deeply regretted) for many excellent photographs of the Færöe islands. Some of the following, taken during last summer, if not altogether geographical, are of exceptional interest. Among these may be mentioned the series depicting a whale hunt in its various stages.

(1) Vaag, looking east; (2) Vaag, looking west; (3) The Great Dimon; (4) Troldkonefingeren, Vaagö; (5 and 6) Cliffs at Vaag; (7) Viderejde; (8 and 9) Cliffs on north-west coast of Osterö; (10) Cliffs on west coast of Stromö; (11) "In tow" going to the whale hunt; (12) Boats assembling in Bordovig bay for the whale hunt; (13) The boat which sighted the whales; (14) Driving the whales into Klaksvig bay; (15) Killing the whales in Klaksvig bay; (16) Harpooning the whales at Klaksvig; (17) Driving the whales into shallow water, Klaksvig; (18) Whale between two boats; (19) A final struggle; (20) Despatching a disabled whale; (21) Waiting to harpoon a straggler; (22) The crowd on shore watching the whale drive; (23) Boats coming in after the "kill;" (24) Whales brought to shore; (25) Whales drawn up on the sand; (26) Whale on shore, showing harpoon wounds and final incision; (27 and 28) Cutting up a whale; (29) Gathering up the fragments; (30) Lading a boat with their share preparatory to starting for home.

Vegetation Types. **Karsten and Schenck.**

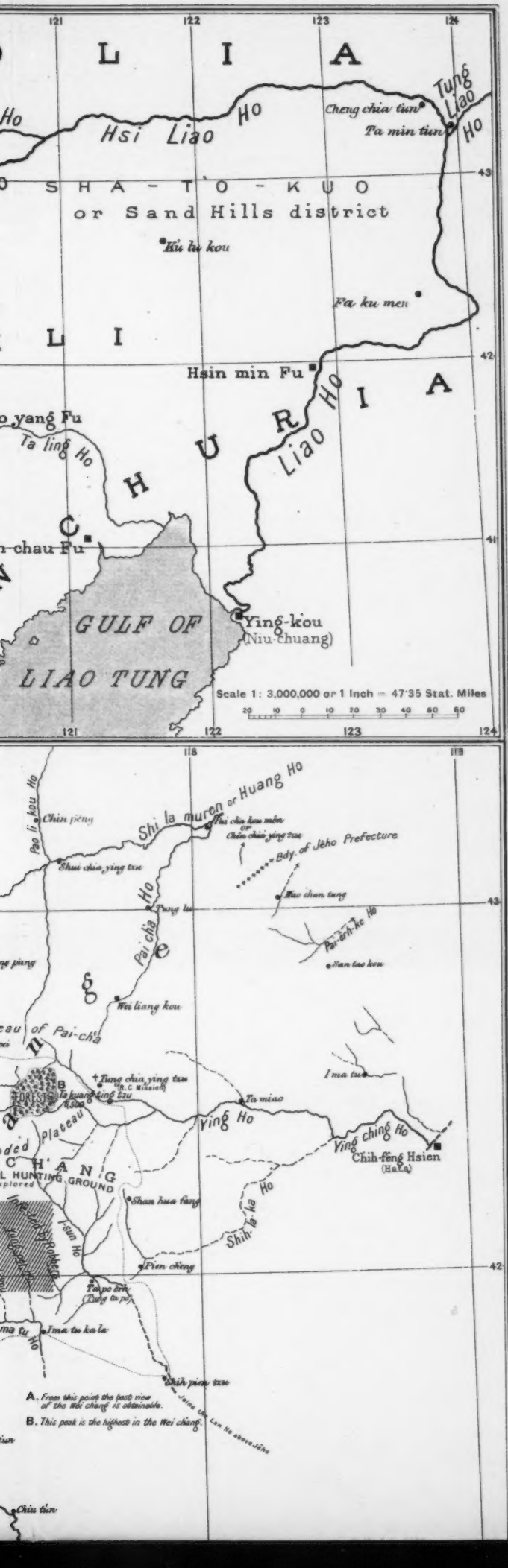
Vegetationsbilder herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Fünfte Reihe, Heft 1 u. 2, Eifel und Venn. Eine pflanzengeographische Skizze von M. Koernicke und F. Roth. Jena: Gustav Fischer, 1907. *Price 2.50m. each part.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

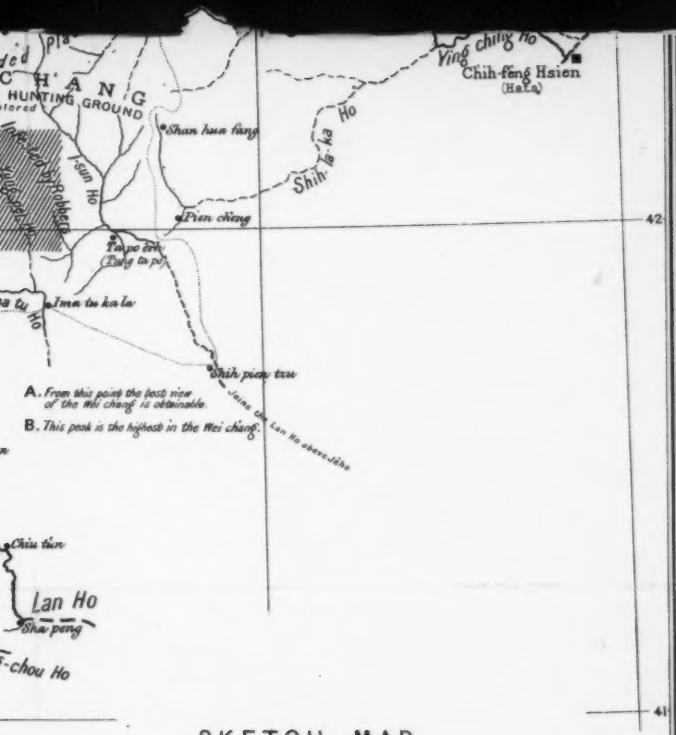

117
118
119
120
M O N G O
Tsagan Muren
Barin
Shara Muren or Huang Ho
Pao li kou Ho
Shara Muren
Lin li Ho
Pa cha Ho
Lo ma Ho
Lao Ho
Wei liang kou
Tung chia tien
Ta huang ting tzu (5500 ft.)
Tsaw san Ho
San tao Ho
WEI-CHANG
IMPERIAL
HUNTING
GROUND
Ying ching Ho
Dolon-nor
Chih feng Hsien
(Hata)
Shih la ka Ho
Lan Ho
C H I
Kuan ti
Shih pien tzu
I ma tu Ho
Tsun Ho
Hsiao lan Ho
T E R
Lao Ho
Tao lao Ho
Chao ya
O U
Chien chang Hsien
(Pa tzu kou)
Cheng tê Fu (Jêho)
Ping chuan Chou
(Pa kou)
Chin cha
M A N
Sketch Map
TO ILLUSTRATE NOTES
on the
LIAO RIVER SYSTEM
and
RIVERS RISING IN WEI-CHANG
117
118
119
120

116
117
Shang kê t'u (Shang tu)
(Cho Nai man)
ANCIENT CAPITAL OF
KUBLAI KHAN
Shang-tu Ho
San-tao Ho
Dolon-nor
Ta pai ssŭ
Mongolian plateau
Plateau
Chao ku tun
Kuan chien tzu
Wooded
W E I - C
IMPERIAL HUN
Hsiao-lan Ho
Ta-ma ling
Ta po tzu
I-ma tu
Kan kou men
Kuan ti
Mongolia
Salt Lake
(R.C. Missions)
Shang tien tzu
Lan Ho
Kuo chia tun
Hsiao chang
Ming tan shan
Kuo chia ying tzu
Chang chia ying tzu
GREAT WALL
Tu-shih kou (ting)
H i
n
a

CHINA
Wingate



Published by the Royal Geographica



SKETCH MAP

OF PART OF

OUTER CHIH-LI

SHOWING

Limits of Wei-ch'ang or Imperial Hunting Ground

and

The Upper Courses of the Lan, Pai, Ying-ch'ing and Huang Rivers

From Original Surveys, 1904, to Illustrate a Paper by

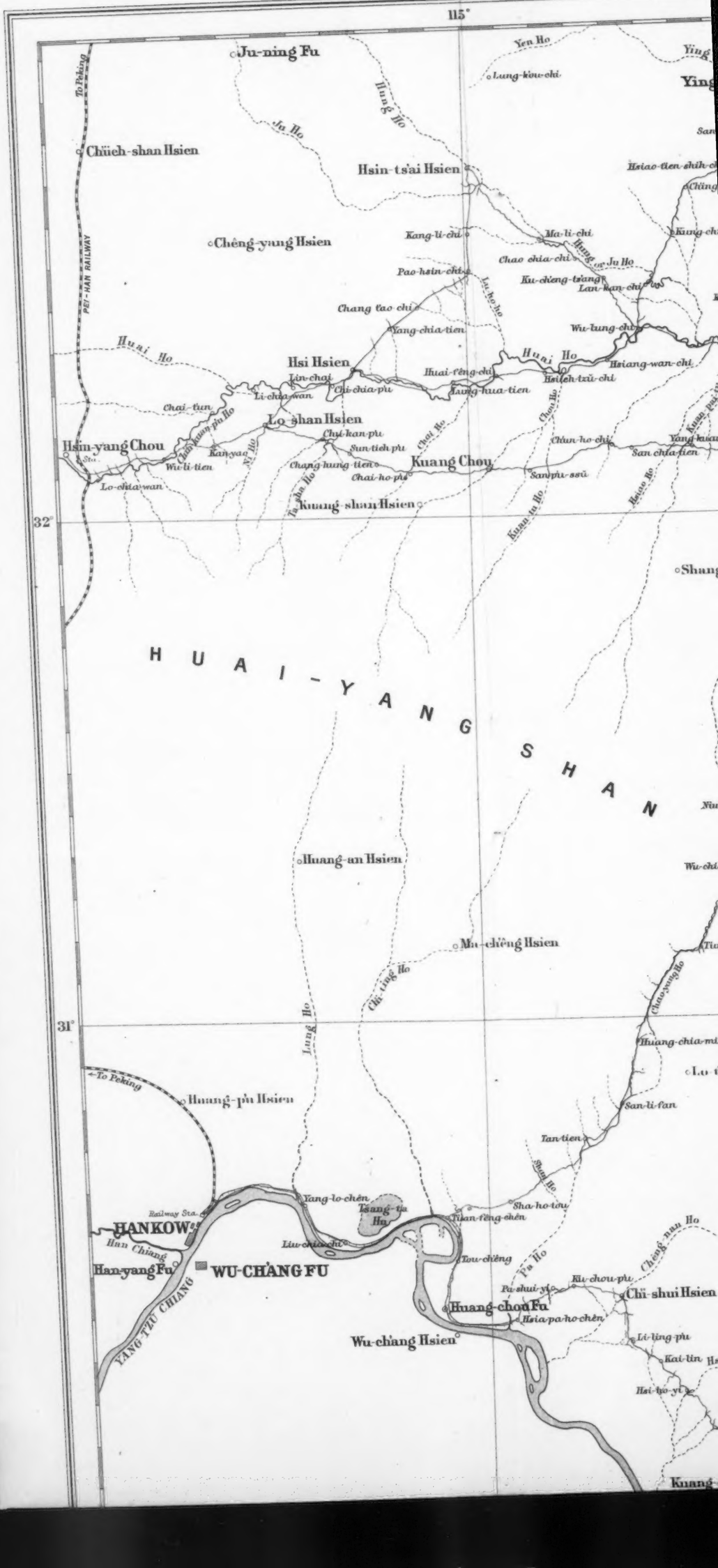
Lieut.-Col. A. W. S. WINGATE

Scale 1 : 1,500,000 or 1 Inch = 23·67 Stat. Miles

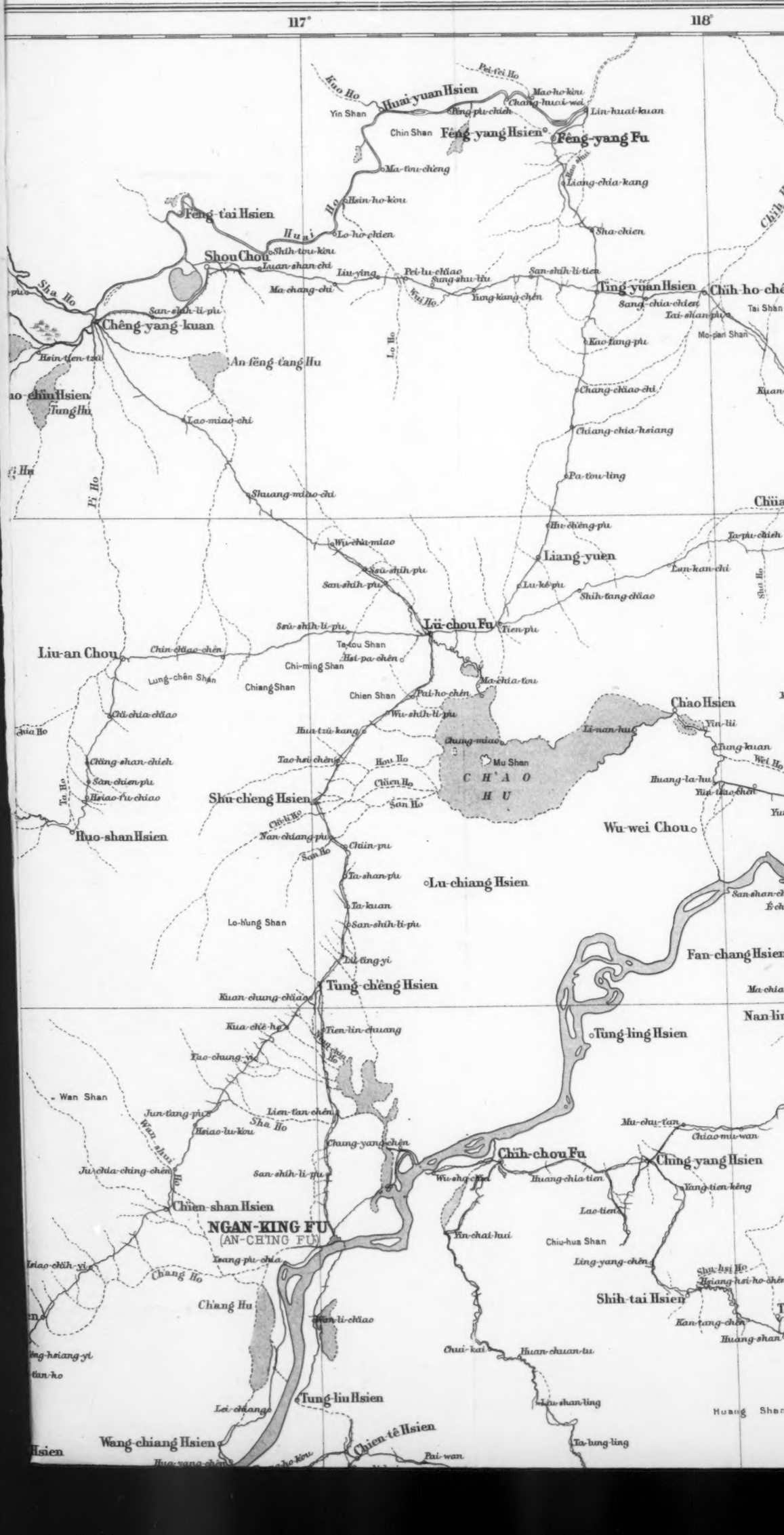
10 0 10 20 30 40 50

118 119

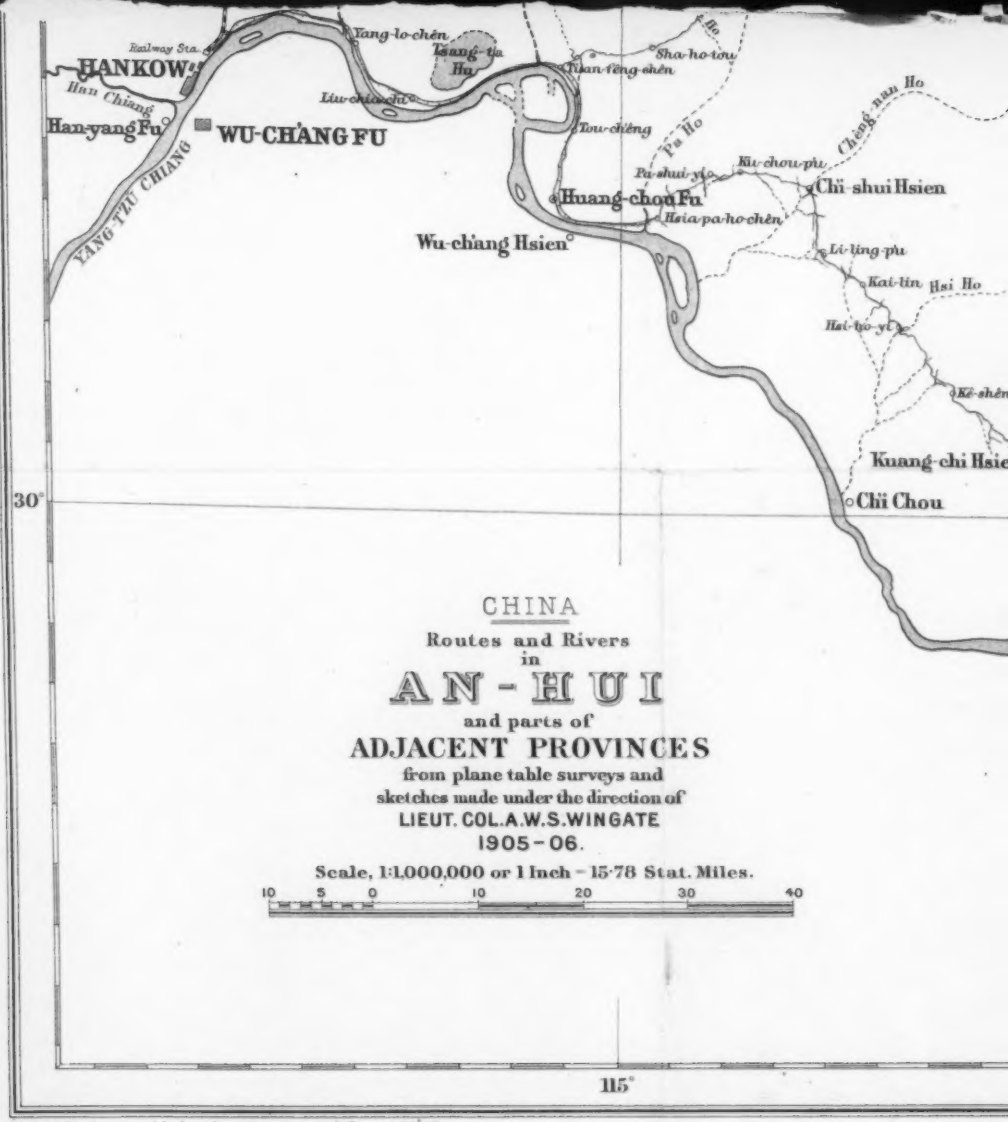
raphical Society.


115°
Ju-ning Fu
To Peking
PEI-HAN RAILWAY
Ju Ho
Huang Ho
Yen Ho
Lung-kou-chi
Chüeh-shan Hsien
Hsin-ts'ai Hsien
Chêng-yang Hsien
Kang-li-chi
Ma-li-chi
Chao chia-chi
Pao-hsin-chi
Ku-cheng-tsiang
Lan-kan-chi
Chang tao-chi
Yang-chia-tien
Lu-ho Ho
Wu-lung-chi
Huai Ho
Hsi Hsien
Lin-chai
Li-chia-wan
Chi-chia-pu
Huai-têng-chi
Hsiang-wan-chi
Hsieh-tzŭ-chi
Lung-hua-tien
Chai-tun
Lo-shan Hsien
Chi-kan-pu
Hsin-yang Chou
Sta.
Wu-li-tien
Kan-yao
Sun-tieh-pu
Chang-hung-tien
Chai Ho
Kuang Chou
Chai-ho-pu
Lo-chia-wan
Ta-sha Ho
Kuang-shan Hsien
Kuan-ta Ho
Chun-ho-chi
San-chia-tien
Hsiao Ho
32°
HUAI-YANG SHAN
Huang-an Hsien
Mu-chêng Hsien
Chi-ling Ho
Lung Ho
31°
To Peking
Huang-pi Hsien
Yang-lo-chên
Railway Sta.
HANKOW
Tsang-ta Ho
Tuan-têng-chên
Liu-chia-chi
Han Chiang
Han-yang Fu
WU-CHANG FU
YANG-TZU CHIANG
Tou-chêng
Pa Ho
Pa-shui-yi
Ku-chou-pu
Chi-shui Hsien
Huang-chou Fu
Hsia-pa-ho-chên
Wu-chang Hsien
Li-ling-pu
Hsi-tu-yi
Shang
Yang-kiau
Huang-chia-mi
San-li-tan
Tan-tien
Shui Ho
Sha-ho-tou
Chang-nan Ho
Kai-lin
Kuang

116°
117°
Ying-chou Fu
Ying-shui Ho
Sha Ho
Ying-shang Hsien
Huai Ho
Feng-tai Hsien
Shou Chou
Cheng-yang-kuan
An-feng-tang Hu
Hsi Hu
Huo-chiu Hsien
Tung Hu
Hung-tang Hu
Ku-shih Hsien
Pi Ho
Lao-miao-chi
Shuang-miao-chi
Shang-cheng Hsien
Liu-an Chou
Shu-cheng Hsien
Huo-shan Hsien
Lu-ch
Tung-cheng Hsien
Lo-tien Hsien
Ying-shan Hsien
Chien-shan Hsien
NGAN-KING FU
(AN-CHING FU)
Tai-hu Hsien
Tung-liu Hsien
Wang-chiang Hsien
Su-sung Hsien
Chien-tê Hsien
Yin Shan
Chin Shan
Ma-tou-cheng
Hsin-ho-kou
Lo-ho-chien
Shih-tou-kou
Luan-shan-chi
Liu-ying
Ma-chang-chi
Pei-lu-chia
Kuo-chiao
San-ho-chien
Wang-kang-chi
Wang-liu-chi
Wang-chia-chi
Hsin-tien-tzu
Chu-kan-pu
Shih-tien-pu
Chuan-ho-pu
Lung-chên Shan
Chiang Shan
Chien Shan
Chi-ming Shan
Ta-kou Shan
Chi-chia-chiao
Ma-pu-cheng
Huang-chia Ho
Chi-li-wan
Nan-chuang-tan
Liu-pu-tung
Liu-chia-ping
Mao-ling
Nu-shih-tan
Chu-lo-an-chên
Wu-chia-tien
Sung-tzu-kuan
Tien-chia-pu
Lo-hung Shan
Kuan-chung-chiao
Tao-chung-yi
Wan Shan
Jun-tang-pu
Hsiao-lu-kou
Ju-chia-ching-chên
Hsiao-chih-yi
Chang Ho
Tien-lin-chuang
Lien-tan-chên
Chang-yang-chên
Tang-pu-chia
Lei-chang
Ke-sheng-pu
Chên-ho-pu
Hsi Ho


117°
118°
Huai-yuan Hsien
Feng-yang Hsien
Feng-yang Fu
Feng-tai Hsien
Shou Chou
Cheng-yang-kuan
An-feng-tang Hu
Ting-yuan Hsien
Liang-yuen
Lü-chou Fu
Liu-an Chou
Chao Hsien
C H'A O H U
Shu-cheng Hsien
Huo-shan Hsien
Wu-wei Chou
Lu-chiang Hsien
Fan-chang Hsien
Tung-ch'êng Hsien
Tung-ling Hsien
Chih-chou Fu
Ch'ung-yang Hsien
Chien-shan Hsien
NGAN-KING FU
(AN-CH'ING FU)
Shih-tai Hsien
Tung-liu Hsien
Wang-chiang Hsien
Chien-tê Hsien
Yin Shan
Chin Shan
Chiang Shan
Chien Shan
Lo-hung Shan
Mo-pan Shan
Wan Shan
Chiu-hua Shan
Huai
Kuo Ho
Sha Ho
Lo Ho
Pi Ho
Wan-shui Ho
Chang Ho
Chang Hu
Tai Shan

119°
32°
31°
NAN-KING
Yang-chou Fu
Chin-chiang Fu
Chu Chou
Liu-ho
YANG-TZŬ CHIANG
Wu-yi Ho
Ho Chou
Tai-ping Fu
Shih-chiu Hu
Wu-hu Hsien
Kao-chun Hsien
Tung-pu-chên
Chien-ping Hsien
Ta Nan Hu
Ning-kuo Fu
Kuang-tê Chou
Ching Hsien
Ning-kuo Hsien
Tai-ping Hsien
Ching-tê Hsien
Chi-chü Hsien
Chiuan-chiao Hsien
Chiang-p'u Hsien
Ta Ho
Chu-lung-chiao
Kuan Shan
Kuan-shan-pu
Wu-yi
Hsi-kê
Chieh-shou
Tung-kou-chên
Pu-kou
Hsiao-chi
Chiao-lin-chên
Pan-chiao
Wu-chiang-chên
Chiang-ning-chên
Chih-ti-pa
Tung-ning-chên
Pi-li-hu
Tsai-shih
Mo-chia-chi-tu
Tan-yang
Pai-tu-chiao
Ta-kua-chu
Hu-chia-tun
Tai-hsiao-chên
Ti-chiao-chên
Ta-sheng-yu
Tu-lun-kou
Kuan-tu-chên
Pai-chia-tien
Chung-shui-ho
Huang-chi
Shui-tou-mên
Nan-tang
Pei-chiao
Hsia-pa
Ting-pu
Mei-tu
Liu-chiang
Fang-tsun-chên
Shih-wei-chên
Chiu-kuan-chu
Huang-tung-chai
Tung-chia
Hsiao-lu-yao
Wan-tzŭ
Hsin-fêng-pu
Tung-mên-tu
Hsin-ho-chuang
Chu-tang-chiao
La-hu-chai
Tai-yang-tsun
Pai-shui-tang
Mêng-ki-tang
Liao-chia-tsun
Huang-ma-tu
Hung-yang-shu
Miao-chia-chi
Hsi-ho-chi
Yu-chia-kou
San-chên
Mi-yang Shan
Pi-chia-chiao
Shih-kan-tu
Miao-pu
Chêng-yi-chiang
Shuang-chiao
Hsia-chia-tu
Yang-liu-pu
Pan-chiao
San-li-tien
Ma-tou
Cheng-yang-tsun
Chin-tsun
Huang-tu
Yang-lin-pu
Pai-tien-chên
Chi-tsun-wei
Hsia-ping-chên
Chên-chia-chiao
Man-kou
Tien-hsin-tsun
Mei-tsun
Chi-li-tang-tien
Chu-ma-tien
Ho-li-chi
Wu-chi-kai
Pai-hua-chên
Yin-tien-shan
Wu-yao-pu
Chê-hsi-chiao
Ha-lou
Tu-wang-tsun
Hou-hu-szu
Chu-ling
Sha-chên
Wang-tow-kang
Tsang-yang-kuan
Yang-chia
Chên-tou
Chin-ling
Tan-chia-chiao
Yang-ên-chên
Shan



CHINA

Routes and Rivers
in

AN-HUI

and parts of

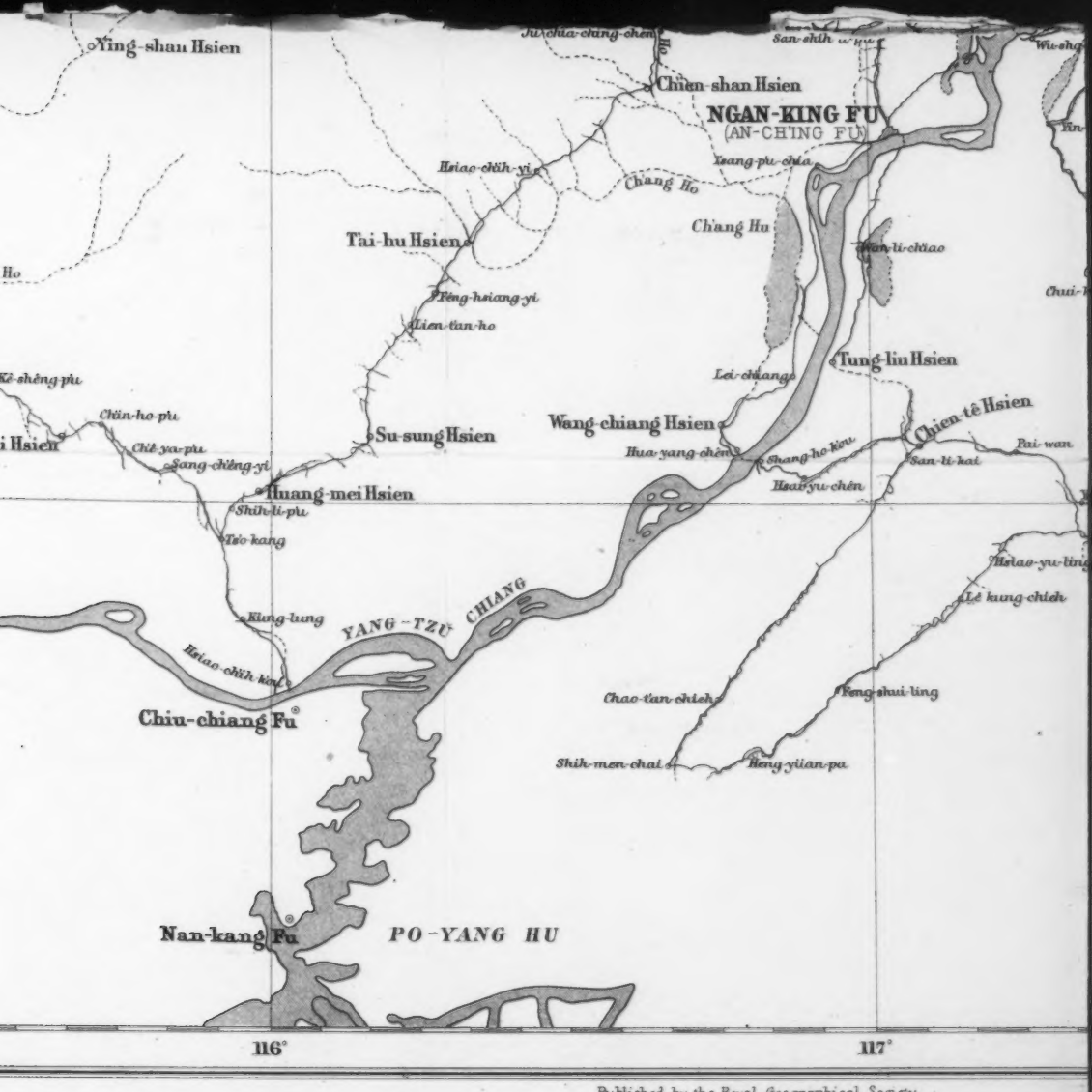
ADJACENT PROVINCES

from plane table surveys and
sketches made under the direction of
LIEUT. COL. A.W.S. WINGATE
1905-06.

Scale, 1:1,000,000 or 1 Inch = 15·78 Stat. Miles.

10 5 0 10 20 30 40

Conical Projection with Standard Parallels 29° 35' and 32° 25'.



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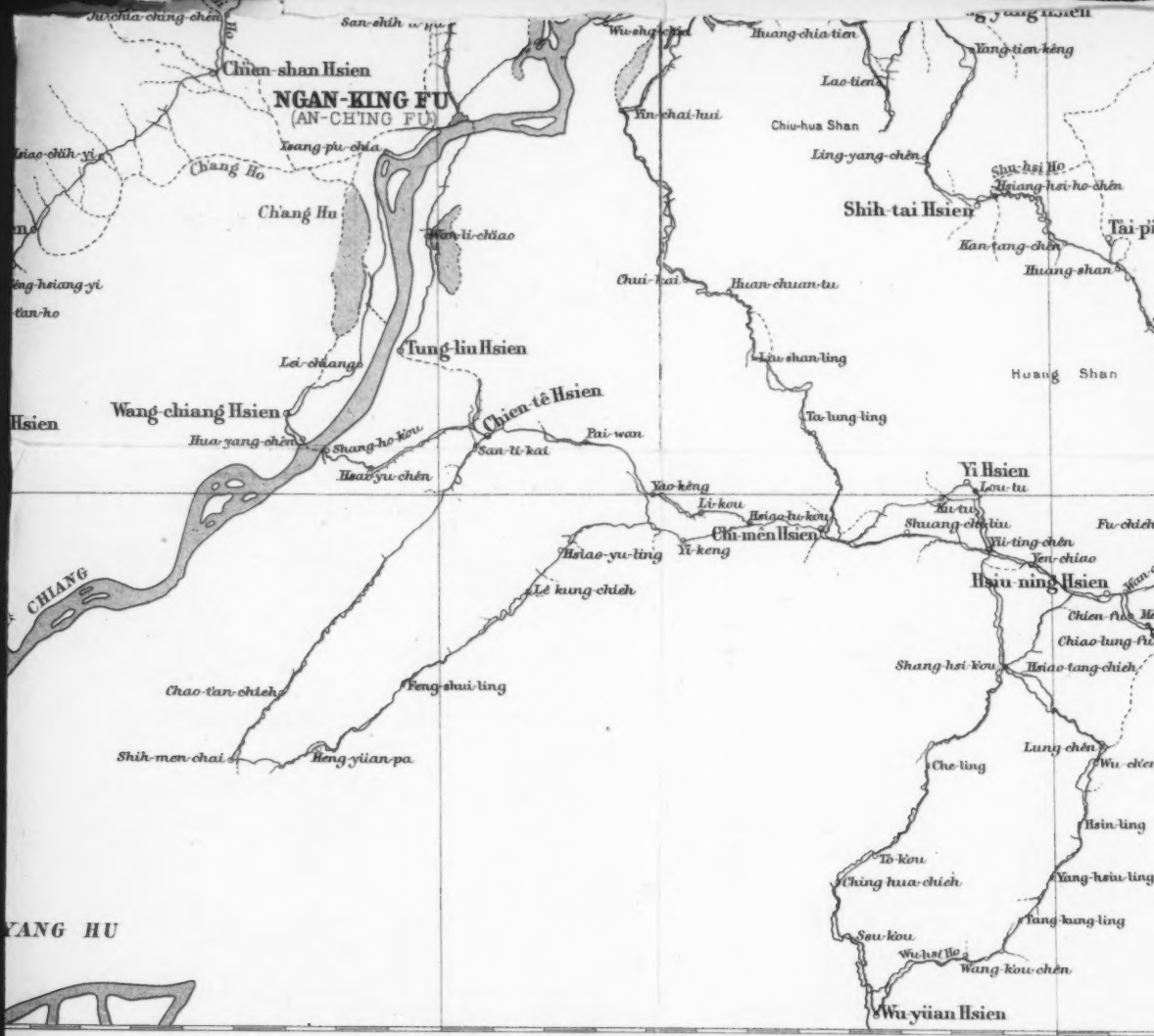
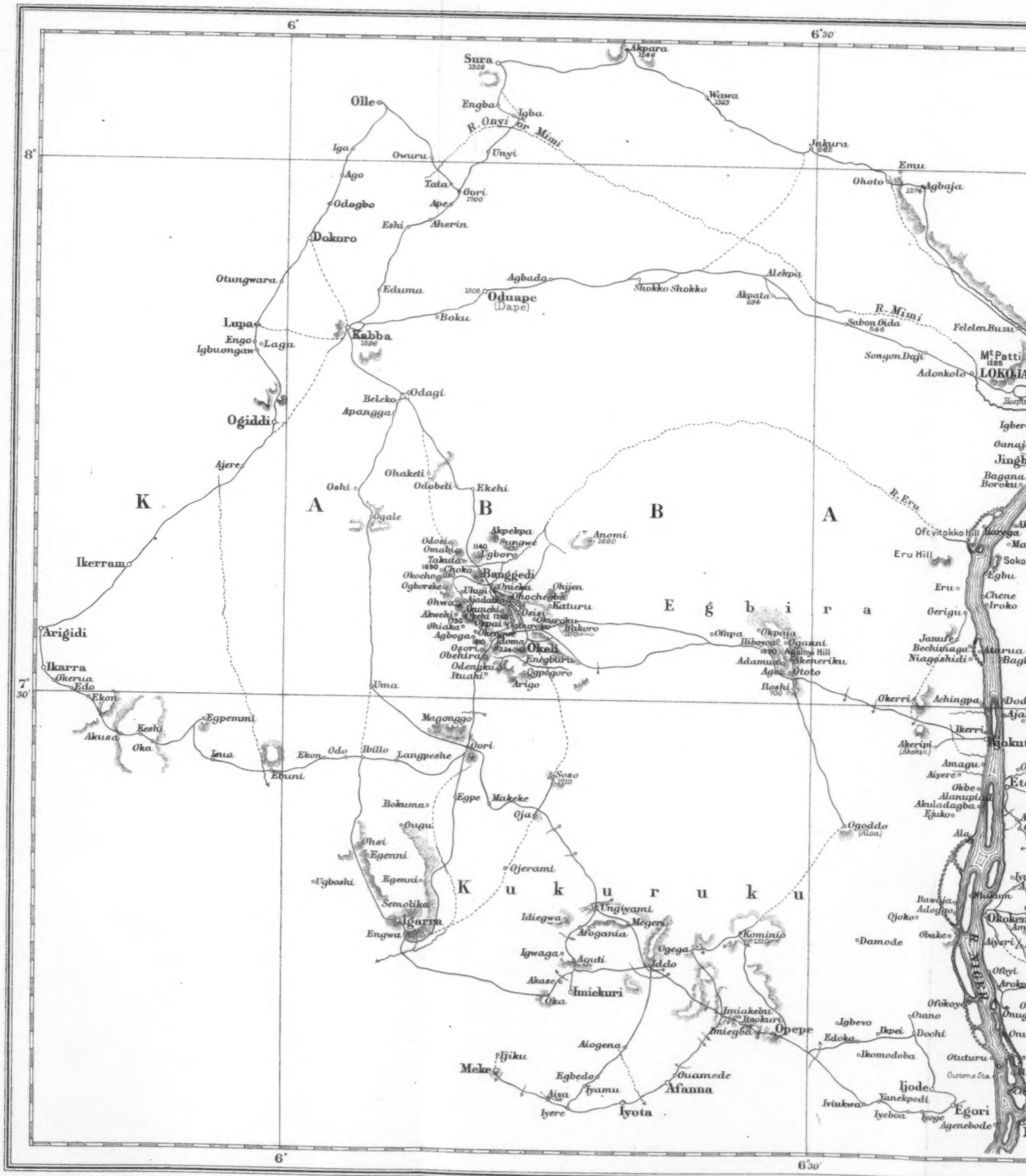


Published by the Royal Geographical Society

Mei-tsun
Chü-li-liang-tien
Chu-ma-tien
Hsü-chi
Ning-kuo Hsien
Wu-chü-kai
Pai-hua-chên
Ti-hsi Ho
Yin-tien-shan
Wu-yao-pu
Ching Ho
Ché-hsi-chiao
Ha-lou
Tai-ping Hsien
Tu-wang-tsun
Hou-lu-szu
Chu-ling
Ching-tê Hsien
Sha-chên
Hua-yü Ho
Tan-chi-a-chiao
Ying-ên-chên
Wang-tou-kang
Tsang-yang-kuan
Chên-tou
Yang-chia
Chin-ling
Chi-chü Hsien
Hsü-tsun-chieh
Ling-chü-chên
30°
Pa-tou
Hui-chou Fu
Kan-kou-chên
Lü-tien
Mei-ling
Nan-chin
Tan-chü-chên
Yang-wu
Explanation.
Roads surveyed shown thus
Rivers „ „ „
Telegraph lines „ „ „
Railway „ „ „
Chiang Ho River
Hu Lake
Shan Hill
ling Pass
Note.
The Yang-tzŭ Chiang is, with slight modifications laid down from the Admiralty Chart. The route surveys have been adjusted to the more recent Admiralty positions of Wu-hu and Hankow.
119°



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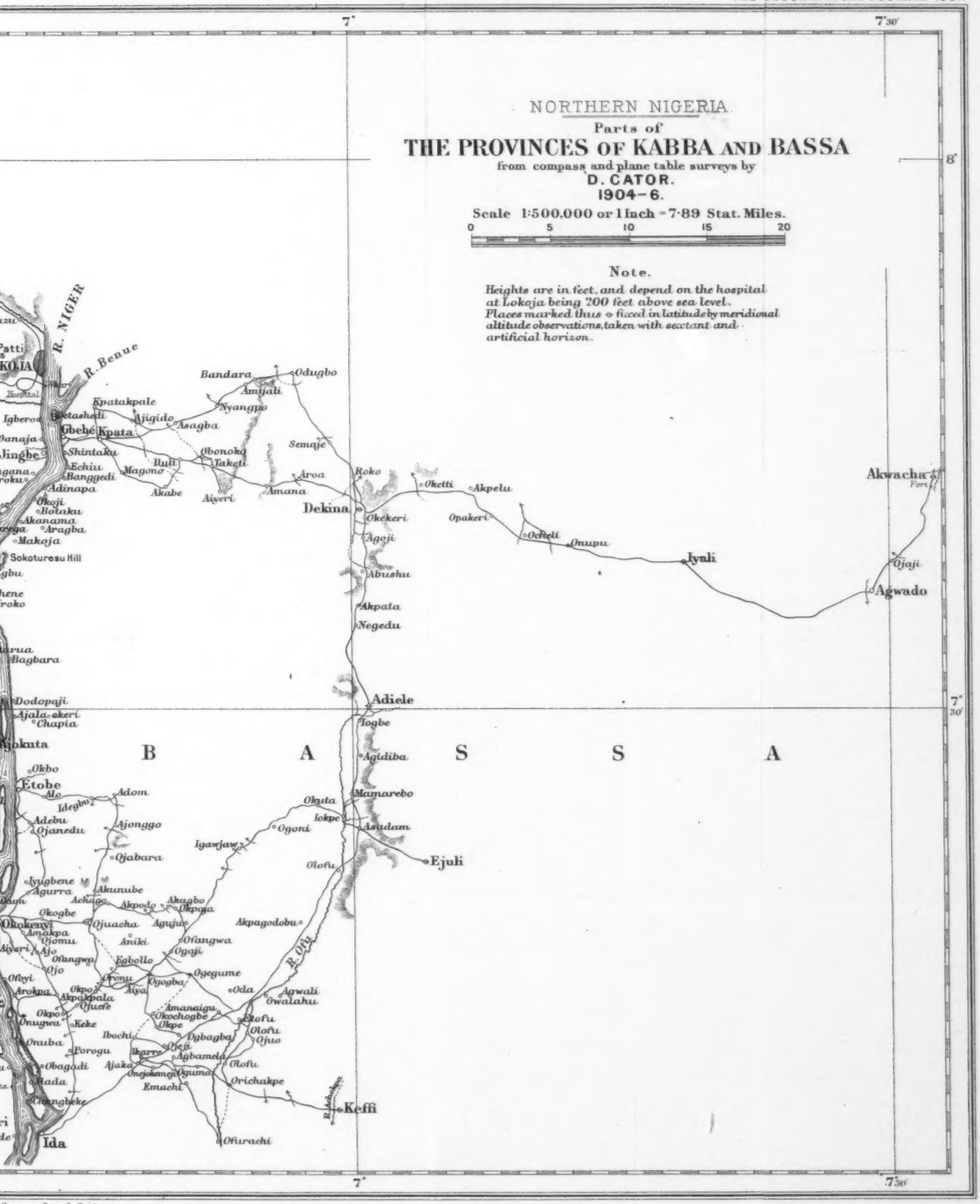
7°
7°30'
8°
NORTHERN NIGERIA
Parts of
THE PROVINCES OF KABBA AND BASSA
from compass and plane table surveys by
D. CATOR.
1904–6.
Scale 1:500,000 or 1 Inch = 7·89 Stat. Miles.
0 5 10 15 20
Note.
Heights are in feet, and depend on the hospital at Lokoja being 200 feet above sea level.
Places marked thus ○ fixed in latitude by meridional altitude observations, taken with sextant and artificial horizon.
R. NIGER
R. Benue
Bandara
Odugbo
Amijali
Nyangwo
Kpatakpale
Ajigido
Asagba
Gbebe
Kpata
Semaje
Obonoka
Taketi
Shintaka
Echiu
Banggedi
Adinapa
Akabe
Aiveri
Amana
Aroa
Roko
Dekina
Okekeri
Ageji
Abushu
Akpata
Negedu
Oketti
Akpelu
Opakeri
Ocheli
Onupu
Iyali
Akwacha
Ojaji
Agwado
Makaja
Sokoturesu Hill
Bagbara
Dodopaji
Ajala-okeri
Chapia
Adiele
Iogbe
Agidiba
Mamarebo
Asadam
Ejuli
Okuta
Lokpe
Ogoni
Igarjaw
Ololu
B A S S A
Okbo
Etobe
Adom
Adebu
Ojanedu
Ajonggo
Ojabara
Iyigbene
Agurra
Akunube
Okogbe
Ojuacha
Amakpa
Ojomu
Aniki
Ofangwa
Ogaji
Egbollo
Ojo
Ofuyi
Arokpa
Okpo
Akpakpala
Ojuche
Onugwa
Keke
Onuba
Porogu
Obagadi
Mada
Ekenghoke
Ida
Ibochi
Ikarra
Ajaka
Onojokenge
Emachi
Ogume
Agbamelu
Orichakpe
Ofurachi
Keffi
R. Ado
Akpagodobu
Ogegume
Oda
Agwali
Owalahu
Imanaigu
Ukochogbe
Okpe
Ekolu
Ololu
Ojuo
Ogbagba
Ololu
Ofangwa
Ogbogba
Aiya
Ogbogbo
Akpodo
Akagbo
Okpoga
Akpo
Ololu
Ololu
Ololu